



SMITHSONIAN

Zoogoer

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FOOD For Thought

Planning the menu
for **400 species**

- » Saving RED OSTRICHES
- » Spend a Day With DARWIN
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FEATURES

JESSIE COHEN/NZP

An Apple a Day

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2009 marks Charles Darwin's 200th birthday and the 150th anniversary of his defining work, *On the Origin of Species*. Today's biologists have great respect and admiration for Darwin and his carefully constructed ideas.

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BY HARVEY LEIFERT

After decades of poaching, civil strife, and habitat degradation, red-necked ostriches are barely surviving. National Zoo scientists are engaged in an all-out effort to save them.



is the dedicated partner of the Smithsonian's National Zoological Park. FONZ provides exciting and enriching experiences to connect people with wildlife. Together with the Zoo, FONZ is building a society committed to restoring an endangered natural world. Formed in 1958, FONZ was one of the first conservation organizations in the nation's capital.

Smithsonian Zoogoer [ISSN 0163-416X] is published bimonthly by Friends of the National Zoo (offices located at the Smithsonian's National Zoological Park, 3001 Connecticut Ave., N.W., Washington, D.C., 20008-2537). Periodicals postage paid at Washington, D.C. Postmaster: Send change of address to Smithsonian Zoogoer, FONZ, P.O. Box 37012 MRC 5516, Washington, D.C. 20013-7012. Copyright ©2009. All rights reserved.

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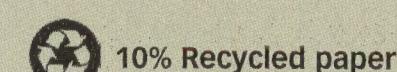
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An audio version of *Smithsonian Zoogoer* is available on our website for members who cannot read standard print due to disability. For more information, please visit www.fonz.org/zoogoer.htm.

On the cover: Visit Nikki, the Zoo's Andean, or spectacled, bear. Photo by Mehgan Murphy/NZP.



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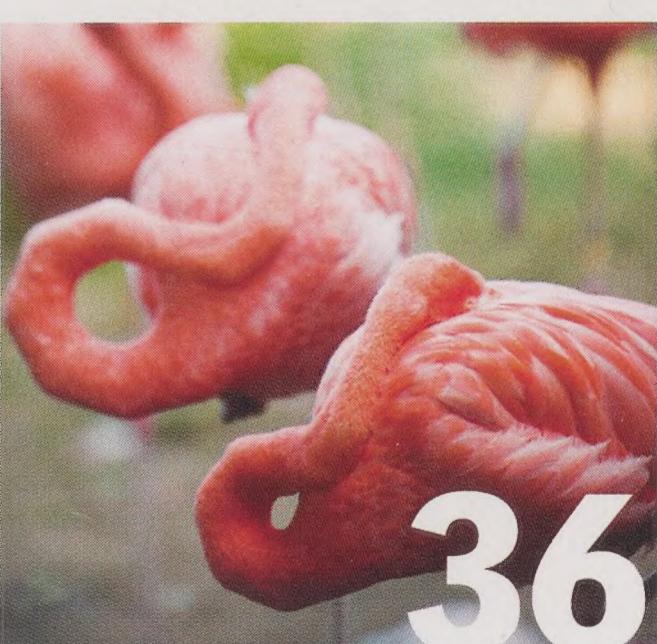
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A GOOD YEAR

AS THE YEAR DRAWS TO A CLOSE, I'M VERY PLEASED TO PROVIDE A PROGRESS REPORT on some of our major construction and renovation projects at the Smithsonian's National Zoo. Over the past three years, we have installed new water lines, a new fire-suppression system, and new alarm systems in nearly every animal building at the Zoo, and we are continuing our progress at our Front Royal campus.

Another major undertaking this year involved building a new genetics lab at Rock Creek. The new energy-efficient lab, located near our veterinary hospital, has bench space for 15 people. Construction was completed last month. The lab's unique location will foster improved collaboration among our scientific teams throughout the Zoo.

Several of our animal exhibits have been undergoing a facelift as well. Phase one of our Elephant Trails Project will debut this year. It includes a spacious outdoor elephant trek. Completion of this multi-million-dollar exhibit is slated for 2011. As part of the construction, we successfully moved Happy, our Nile hippopotamus, to the Milwaukee County Zoo. Happy is now housed in a spacious new exhibit with two prospective mates!

Also this past fall, our complete overhaul of the seal and sea lion exhibit began. Our sea lions were transferred to the Pittsburgh Zoo, where they will stay during project construction, with hopes of breeding with sea lions there, and our seals were moved off exhibit to a newly constructed pool near the veterinary hospital. The new exhibit will include state-of-the-art wave pools and filtration systems, an underwater viewing area, and space to accommodate several more seals and sea lions. It is scheduled to be completed in 2011. Check our website for a virtual tour of this new and exciting exhibit.

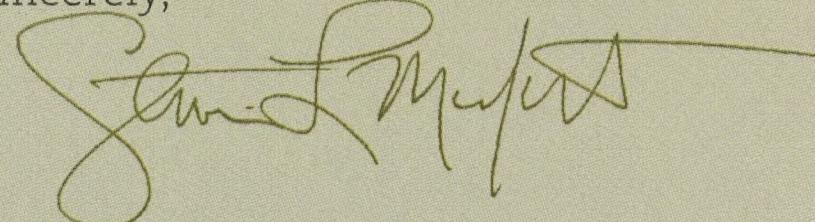
In addition to the projects at Rock Creek, we successfully upgraded our facilities at the Front Royal, Virginia, campus as well. Renovations there included improvements to the roofs of several buildings, upgrades to our animal barns, and new utilities and water lines. As part of the ongoing facilities improvement plan, we are planning to construct a new clouded leopard facility dedicated to the breeding and study of this elusive and threatened species. National Zoo scientists have been leading the international effort to ensure the long-term survival of this unique animal, and I would encourage you to consider a donation to our annual appeal campaign (see page 7). The new facility will include spacious outdoor enclosures where the cats can climb and play as they would in the wild. Climate-controlled indoor facilities will provide shelter for the animals and allow for the safe introduction of prospective mates.

Finally, I wanted to note the work being done by National Zoo scientists and the Sahara Conservation Fund (SCF) on behalf of the endangered red-necked ostrich (see feature on page 24). After decades of poaching, civil strife, and degradation of their habitat, these unique animals only exist in a few isolated places. As one of the SCF founders and its current chair, I am proud to highlight the Zoo's commitment to working in this unheralded and misunderstood region of the world—not only to save the red-necked ostrich, but also dama gazelles, cheetahs, striped hyenas, and many other species.

As we end 2009, I'd like to thank our dedicated staff and volunteers for all their hard work and commitment to making this the world's finest Zoo. I am very proud to be part of this organization and look forward to new and exciting projects in 2010.

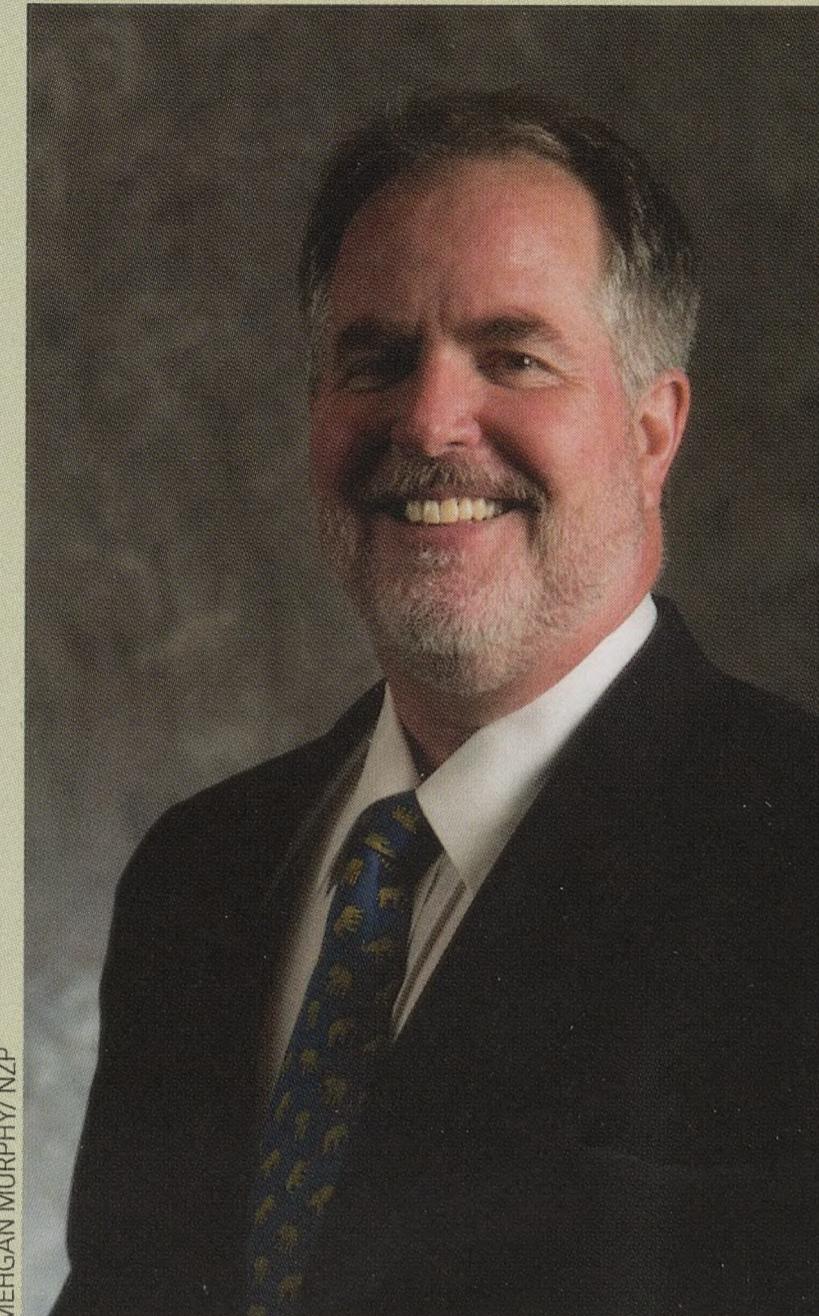
Happy holidays.

Sincerely,



Steve Monfort

Acting Director, Smithsonian's National Zoological Park



MEGAN MURPHY/NZP

IT TAKES A VILLAGE



THROUGHOUT THE COURSE OF THE YEAR, I'VE HAD THE PLEASURE OF HEARING FROM FONZ MEMBERS AND OTHER ZOO GUESTS about their memorable Zoo visits and extraordinary experiences here at the park.

This effort to touch people's lives deeply and to engage them in the issues that confront animal conservation requires the work of a great many people. The "it takes a village" approach is essential to operate the Zoo, to educate the public, and to share our passion with the wider community that visits the Zoo, on foot and on our website. It's the combined efforts of veterinarians, electricians and plumbers, horticulturalists, volunteers, scientists, nutritionists, web editors, animal keepers, communications and event staff, membership and development staff, accountants—and the list goes on and on—that help us meet our animal care, science, education, visitor experience, and sustainability goals; all while accommodating 2.3 million visitors on site and engaging millions more online.

As we approach Thanksgiving, it's appropriate to thank this dedicated team of Zoo and FONZ staff and volunteers for their loyal service this past year—and you, our FONZ members, for your continued support of the work that we do.

As fall changes to winter and the holiday season arrives, I invite you all to visit the Zoo and enjoy all the animals that look forward to the colder temperatures outside. While you are here, enjoy a cup of coffee and a sandwich at the restaurant and be sure to stop by our gift shop (or go online) to purchase a unique gift or two for those special people on your holiday gift list.

I encourage you to spend an evening attending our fabulous ZooLights celebration again this year. We are entering our third year of ZooLights, with even bigger and brighter displays. With a special nod of thanks to our sponsor, Pepco, we will be hosting this event beginning December 4 and running through January 2. Please visit our website for the dates and times and to purchase tickets online.

As we close 2009, we also wrap up the first year of our newly redesigned magazine. We hope you've enjoyed the new look and the information and resources provided. We'd love to get your feedback, so please send us your comments via email to Zoogoer@si.edu.

Thanks again for your continued membership, and we look forward to a bright and wonderful 2010.

Happy holidays!

Sincerely,

A handwritten signature in cursive ink that reads "Bob Lamb".

Bob Lamb

Executive Director, Friends of the National Zoo

ANIMAL NEWS

FIRST BURROWING OWL CHICKS IN 30 YEARS

In August, the National Zoo welcomed two burrowing owl (*Athene cunicularia*) chicks—the first hatching of this species at the Zoo in 30 years. The chicks are with their parents in the Zoo's Bird House. Semi-transparent filter paper covered their exhibit, providing the chicks with privacy. As they become more comfortable with their new surroundings, the paper will gradually be removed, and they will be on exhibit this month. The burrowing owl is named for its habit of living in underground burrows. It can excavate its own hole, but usually uses a burrow dug by another animal. The Zoo's owls are provided with tunnels and underground nest boxes. Much of the population is migratory, although migration routes and locations are not well understood. Burrowing owls live along the Mississippi River to the Pacific Ocean and from the Canadian prairie provinces into South America. They are also found in Florida and the Caribbean islands.



SEE THE CLOUDED LEOPARDS ON CAMERA Tune in to the Front Royal campus's new clouded leopard cam at http://nationalzoo.si.edu/goto/clclub_cam and watch these rare and endangered cats leap into action.



MEHGAN MURPHY/NZP

Dama Gazelle Born in October

On October 1, the National Zoo welcomed a healthy baby dama gazelle (*Gazella dama*), born to three-year-old Adara and two-year-old Rajih. The pair's first calf, Fahima, was born in November 2008 and has taken a keen interest in her new sibling! Damas are the world's largest and rarest gazelles—a mere 500 remain in the wild.

CORAL SYMPOSIUM

How do you save an animal that is notoriously difficult to raise in captivity? Scientists, coordinators, and professional aquarists from all over the world hope to answer that question when they gather at the Invertebrate Exhibit for an **elkhorn coral** (*Acropora palmata*) workshop on November 12 and 13. This event, hosted by the Smithsonian's National Zoo and funded in part by NOAA and Counterpart International, Inc., seeks to save this endangered animal, whose populations have dwindled by almost 90 percent since the mid-'80s. Can't get enough of coral? Learn how you can help save the species during a free public panel discussion, which will take place at 6:30 p.m. on November 12 at the Zoo's Visitor Center. Please visit our website for more information.



MEGAN MURPHY/NZP

From Lion/Tiger Hill
The lion and tiger exhibit repairs should be completed this month. In other news, Shera (one of our lionesses) will celebrate her fifth birthday in November. Lionesses become sexually mature around age five.

EXHIBIT NEWS



MEGAN MURPHY/NZP

FROM THE ELEPHANT HOUSE The Elephant House closed in September and will remain closed until the grand re-opening in 2011. Ambika, Shanti, and Kandula will remain on exhibit in the outdoor enclosures during exhibit hours, but may occasionally be inside and out of view. The elephant bath demonstrations have been suspended until the re-opening, but visitors can still watch the training demonstrations at 11 a.m. every day (weather dependent). In the coming months, the renovated Elephant House will be transformed into the Elephant Community Center. The project will be complete in late 2011.

Seal and Sea Lion Exhibit Update

The Zoo will soon begin construction of the new seal and sea lion exhibit, which will be completed in 2011. Because of construction, our two female sea lions, Calli and Summer, moved to the Pittsburgh Zoo in early October and will remain there until the new exhibit is finished. The seals, Gunnar and Selkie, will remain at the Zoo but be off exhibit. Construction will affect some neighboring animals as well. Pelicans will be off exhibit. Eagles will be off exhibit for six months, then move to another location on the Valley Trail. Mexican wolves will move temporarily to another institution. Beavers and otters will remain on display, but times may vary. Please visit our website for updated information and a virtual tour of the new exhibit.

A Brighter Future for Clouded Leopards

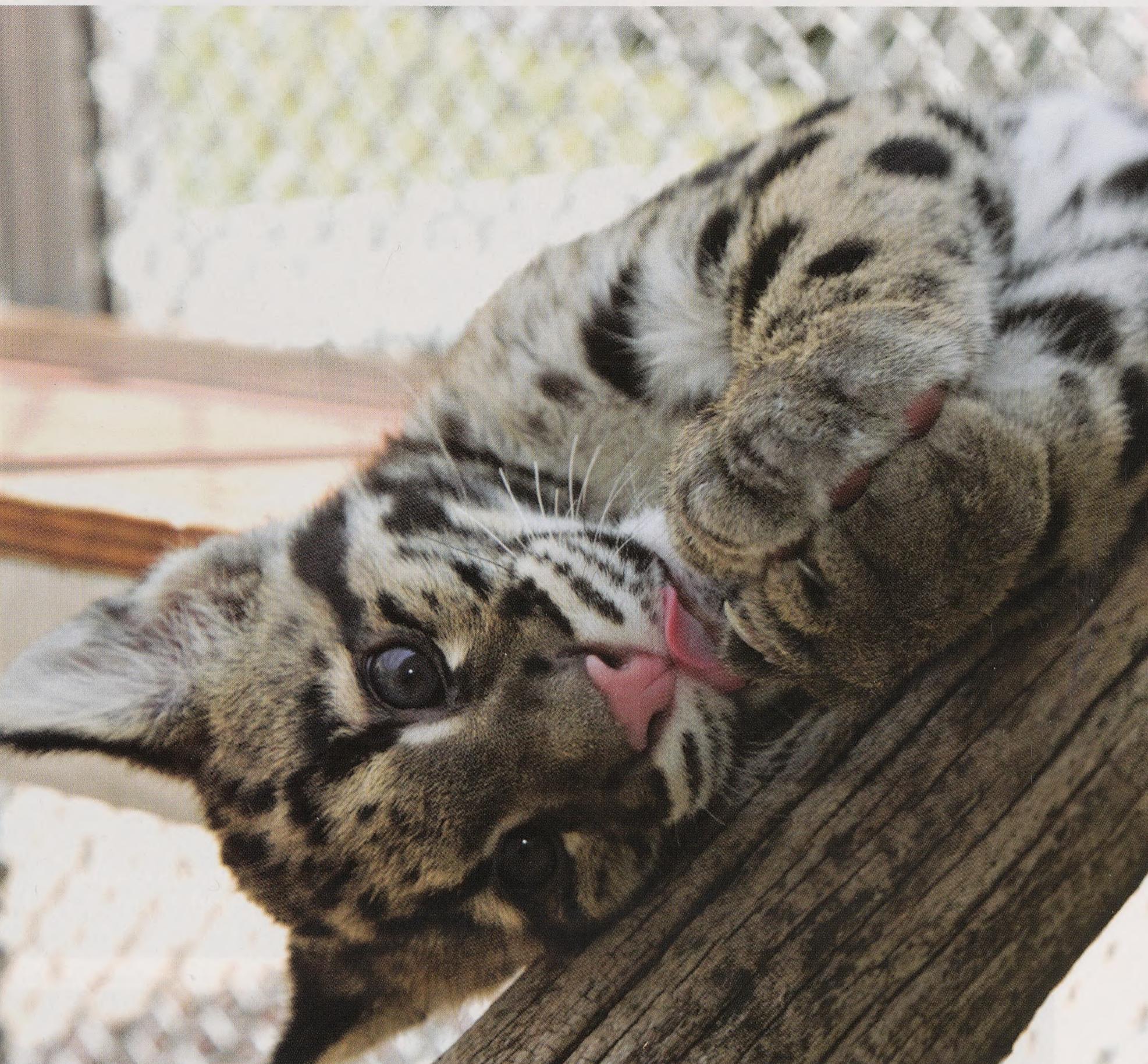
Help Us Build Them a New Home

CLOUDED LEOPARDS are among the most elusive and threatened species of cat in the world. Found throughout Southeast Asia, these animals are distinguished by their cloud-like markings and large canine teeth. Threatened by high demand for their pelts and the rapid destruction of the forest habitats they call home, clouded leopards face an uncertain future both in the wild and in zoos. National Zoo scientists have been leading the international effort to ensure the long-term survival of this amazing animal, but we need your help.

This year, FONZ is raising money to support the construction of a new facility dedicated to the breeding and study of clouded leopards at the Zoo's Conservation and Research Center (CRC) in Front Royal, Virginia. Tucked away in a secluded and forested part of CRC, the new facility will include spacious outdoor enclosures where the cats can climb and play as much as they would in the wild. Climate-controlled indoor facilities will provide shelter for the animals and allow for the safe introduction of prospective mates. We need your support to build this new home for our clouded leopards.

Go to www.fonz.org/savecloudedleopards.htm for more details about the **2009 Annual Appeal** and how you can help secure a brighter future for clouded leopards.

MEGHAN MURPHY/NZP



Statement of Ownership — Zoogoer (ISSN 0163-416X)

Friends of the National Zoo
P.O. Box 370125 MRC 5516
Washington, DC 20013-7012

Publisher: Robert J. Lamb
Editor: Jodi Legge

\$8 of membership dues goes to subscriptions

	NO. OF COPIES SEPT/OCT 2009 ISSUE AVG.	NO. OF COPIES PRECEEDING SIX ISSUES
Net press run	40,000	40,000
Paid outside-county subscriptions	33,647	33,516
Paid in-county subscriptions	5,312	5,354
Sales through carriers, counter sales	0	0
Total paid/requested circulation	38,959	38,870
Free distribution by mail	100	100
Free distribution outside mail	664	749
Total free distribution	764	849
Copies not distributed	0	0
Total distribution	39,723	39,719
Percent paid/requested circulation	98 %	98 %

ACF WRAP-UP

The Autumn Conservation Festival was held in Front Royal, Virginia, on October 3 and 4, providing a rare opportunity for the public to see our facility and meet our scientists. Our clouded leopard cubs even made an appearance, delighting the crowds. A special thank you to our media sponsor, The River 95.3, for its support of this event.

Mark Your Calendar

Nov. 14 Conservation Stamp Day. See ad on the back cover.

Nov. 20 Lecture on *The Age of Empathy*, a book by Frans de Waal, at 7 p.m. in the Visitor Center auditorium.

Dec. 4-Jan. 2 ZooLights. See ad below.

Jan. 10-Mar. 7 When the winter weather outside is frightful, come to the Smithsonian's National Zoo for our new Wild Side Stage performance series for children! Join us for performances featuring a 2009 Grammy-nominated musician, puppeteers, dancers, storytellers, and more. After each performance, you'll have the opportunity to meet-and-greet keepers and the animals that inspired it all. Find out more and purchase tickets (\$5 for members, \$7 for nonmembers) at www.fonz.org/wildsidestage.htm.

WHERE: Smithsonian's National Zoo's Visitor Center Auditorium

WHEN: January 10, 24
February 7, 21, 28
March 7
There will be two performances each of these Sundays at 11 a.m. and 1 p.m.

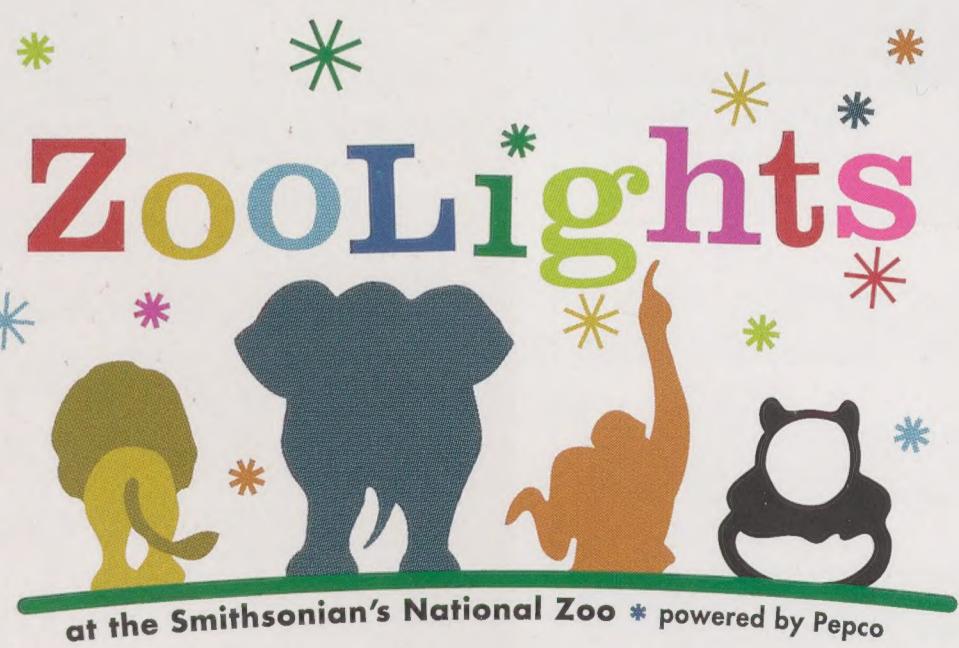


MEGHAN MURPHY/NZP

CONGRATULATIONS Horticulture Team!

Searching for the most beautiful gardens in the nation? Look no further than the National Zoo, which recently won the Grand Award from the Professional Grounds Management Society in its 2009 Green Star Award Competition. Congratulations to our creative and devoted grounds crew, who maintain all 163 acres of the Zoo and keep it looking beautiful year-round!

NOTICE: The National Zoo will not be hibernating this winter



Instead, we will be hosting the **biggest, brightest event** of the year: the **third annual ZooLights!** See more lights, new displays, great entertainment, enthralling puppetry, and of course, exotic animals, all at a special lower ticket price! This is the family event of the season, and it is guaranteed to **bring your holidays to life.**

ZOOLIGHTS

December 4 - 13 (Friday through Sunday nights)

December 18 - January 2 (Every night except December 24, 25, & 31)

FONZ members: \$5 Nonmembers: \$8

Get your tickets at www.fonz.org/zoolights.htm.

ZooLights is generously sponsored by: Pepco, SunTrust Bank, Giant Food, Whitmore Group, The Washington Post/Kids Post, 97.1 WASH-FM, Hair Cuttery, and Rosenthal Jaguar/Land Rover.

THE DOCTOR IS IN

Tai Shan reached his furry, black-and-white arm out for a blood draw. At the National Zoo, veterinarians and keepers have trained the pandas to cooperate for blood tests and other routine health exams that would require anesthesia, making check-ups easier for both doctors and bears.

"We can do pretty much anything with the pandas—blood samples, injections, ultrasound, radiographs. It's amazing," said Associate Veterinarian Carlos Sanchez. "They don't hate you; they look forward to seeing you. They know they just need to stand still for a couple pricks and that's it."

Originally from Colombia, Sanchez grew up in Mexico City, where he became fascinated with pandas as a kid while visiting Mexico's National Zoo with his family. After waiting in line for hours to see a baby panda, Sanchez was hooked.

In 2000, he became the first Latin American veterinarian ever accepted into a zoological medical residency program in the U.S. "I always say, 'I'm not the best, but I'm the most persistent.' That's why I am where I am now."

Tall with rectangular glasses, short spiky hair, and a quiet demeanor, Sanchez's typical reserve is broken by an uncontrollable smile when he talks about the animals and his work here at the Zoo. On an average day, Sanchez might treat a sick elephant shrew, x-ray a lion, conduct a visual exam on a gorilla, perform a renal exam of a cheetah, and deworm a Przewalski's horse.

"Zoo medicine is both a science and an art," Sanchez said. "You can be the most knowledgeable veterinarian, but you also need common sense and a little experience."

Between exotic animal appointments, Sanchez teaches at universities around the globe and chairs the American Association of Zoo Veterinarians International Committee, a diverse community of veterinarians and institutions dedicated to sharing research and boosting the quality of zoo medicine throughout the world.

"Zoo medicine practiced in this country is at an incredibly high level," Sanchez said. "Some countries are still 20, 25 years behind. I think a goal for all of us who have had the opportunity to train in the U.S. should be to help vets in other countries achieve a similar level."

Through his desire to share his knowledge, Sanchez developed the International Veterinary Training Program at the National Zoo. Since 2003, veterinarians from all over the world have come to spend six to eight weeks in clinical training here. In addition, veterinarians from our Zoo train vets and other zoo medicine professionals in their own countries.

Sanchez also runs LatinVets, an information-sharing resource. What began in 2001 as a small, bilingual List Serve for Latin American veterinarians now provides 860 vets from Latin America, Spain, Portugal, Italy, and the U.S. with a forum for discussing clinical cases and disseminating information about grants and field programs.

When Sanchez isn't tending to sick animals, traveling the globe teaching, or appearing on Animal Planet, he still finds time to hit the gym and read a good book.

"When I was a kid, my mom always told me, 'Do what you want to do, whether it's a doctor, a carpenter, anything. But be the best.'"



JESSIE COHEN/NZP

» In each issue of *Smithsonian Zoogoer*, this "How Do You Zoo?" page will showcase someone who works at the National Zoo. Learn more about careers at the Zoo by visiting the How Do You Zoo? exhibit at the Zoo's Visitor Center. Children ages five to ten can get a hands-on feel for different jobs at the Zoo. The exhibit is open most weekends from 10 a.m. to 4 p.m.

—CAROLINE TREADWAY

AN apple A DAY

BY BRITTANY GRAYSON

**The Smithsonian's
National Zoo is one
of the few zoos
across the country
that has a dedicated
nutrition department
and an enormous
commissary to
feed all of its animals
at Rock Creek
and Front Royal.**

Nikki, an Andean bear, (*Tremarctos ornatus*, also known as the spectacled bear) wakes up every morning around 9 a.m. He lumbers to his feet. He's not a small bear, at approximately 340 pounds, but he's an active one. His keepers open his door to let him out into his enclosure where, it seems, someone has left goodies spread all over the yard. He finds an apple behind a rock and munches it thoughtfully as he begins his day at the Smithsonian's National Zoo.

In the wild, Nikki would be foraging through the Andean forest for berries, bulbs, and bromeliads, and he might spend a significant portion of his day hunting for food—stripping bushes, digging, and walking miles to find what he needs to stay alive and healthy.

Being a zoo-dwelling bear, Nikki doesn't have to worry about what he eats. He has a team of people, from keepers to vets to nutritionists, who determine the best diet for him.

The National Zoo is one of the few zoos across the country that has a dedicated nutrition department, which includes two full-time animal nutritionists, a commissary manager, a food specialist, and a staff of nine full-time animal keepers, and an enormous centralized commissary that feeds all of the animals at the Zoo.

Karen Lisi, one of the Zoo's animal nutritionists, is just one of the people on the front lines who worry about what Nikki does (and doesn't) eat. Lisi is responsible for making sure that all the animals at the Zoo eat properly, which is quite a challenge, since the Zoo is home to thousands of animals belonging to more than 400 species.

The Zoo's nutritionists have extensive backgrounds in animal nutrition, but scientists don't know a lot about the diets of most wild animals. Humans have raised and fed domesticated animals, such as poultry, cattle, horses, dogs, and cats for hundreds of years, though, and Lisi views this knowledge as a good starting point. Many of the animals at the Zoo aren't well studied, and there are large gaps in our knowledge of what they eat in the wild.



JESSIE COHEN/N2P

LEFT: Nikki enjoys his yard.
ABOVE: Deb Grupenhoff prepares fruits and vegetables for animals at the Zoo.



Even in cases where scientists do know what an animal eats in the wild, it's almost impossible to replicate that diet in a Zoo setting, either because of logistics or because the nutrients in fruits and vegetables vary depending on the climate and soil where they grow. Instead, nutritionists focus on ensuring that animals get all the nutrients they need. They can tell an astonishing amount about what an animal should eat from the anatomy of its gastrointestinal (GI) tract.

"If I know the GI tract of an animal, it really doesn't matter if it's covered with scales or fur or feathers. In general I can figure out what to feed it," Lisi explains. "The important information about the feathers, scales, or fur is the animal's energy requirements. Birds, reptiles, and mammals have very different metabolic rates. The GI tract may tell me what to feed it, but I also need to figure out how much to feed it."

The nutrient and calorie content of each diet isn't just a guess. Lisi uses elaborate mathematical equations to balance out nutrient loads, stomach capacity, and metabolism of the animals to figure out what they need. "You have to enjoy math to enjoy all the equations that go into figuring out nutrient requirements for animals."

The First Zoo Nutrition Lab in the U.S.

The National Zoo built the country's first zoo nutrition lab back in 1980, and it's still a rare feature at zoos today; in fact there are fewer than five nutrition labs at U.S. zoos. Our lab is stocked with ovens for drying samples, centrifuges for separating out ingredients, and a myriad of devices that not only tell scientists what the fat, protein, or carbohydrate content of any food is, but can also determine the amounts of all the useful vitamins and minerals.

This lab, led by Michael Jakubasz, nutrition lab manager, is also well equipped for scientists from the Zoo and from other institutions all over the world to study what animals eat in captivity and in the wild. Currently, Zoo scientists are

carefully studying the diets of two dusky titi monkeys (*Callicebus moloch*) and a two-toed sloth (*Choloepus didactylus*). They meticulously measure what and how much each animal eats, and then analyze its feces to see how much of it the animal has absorbed. Detailed knowledge like this is rare for even zoo species, and it's extremely valuable. Scientists share this knowledge throughout the zoo and the scientific community, so that every day, animal care experts know a little bit more about the world than they did the day before.

Creating the Perfect Diet

The nutritionists use all this knowledge to create a diet for each animal in the park. They detail exactly what each animal should eat, in precise quantities on diet sheets.

"They're almost recipe sheets," Lisi explains. "They're very straightforward. Of course, the diets are constantly changing as animals come into the collection, are moved around, we have a birth, or there is a change in health status."

As a Zoo nutritionist, Lisi is works with dozens of people to implement and monitor the diets of each animal. This collaborative effort includes the veterinary staff and the animal keepers.

This precise formula becomes very important when animal care staff are trying to change an animal's weight. Take Nikki, for instance. When he came to the Zoo, he was accustomed to eating all sorts of sweets, and he was grossly overweight. Keepers and vets work together to determine an animal's body



JESSIE COHEN/NZP



JESSIE COHEN/NZP

ABOVE: Tyrone Savoy weighs and measures diets for the primates.

BELOW: Food is labeled and dated for freshness.

What's in the Baby's Bottle?

Formulating a diet for a grown animal is hard enough. But the difficulty increases exponentially when nutritionists try to figure out what to put in a baby animal's bottle.

Milk varies widely across mammals, and nutritionists have to try to replicate the nutrients newborn animals need. Many zoos, including the National Zoo, used to hand-rear animals frequently, but today they only hand-rear in special situations where doing so ensures the animal's future health and well-being.

Recently, the Zoo began hand-rearing a red panda (*Ailurus fulgens*) cub and three clouded leopard (*Neofelis nebulosa*) cubs. The clouded leopards got a milk formula that's a mixture of two different commercially available cat formulas. But since red pandas aren't closely related to any large domesticated group, nutritionists decided to feed the red panda cub a formula Zoo

nutritionists initially developed for giant panda (*Ailuropoda melanoleuca*) cubs. Although the two species aren't closely related, both eat primarily bamboo, so the nutrient requirements for newborns are similar.

Not only do nutrient needs differ between species, but scientists think they might change with time as well. To help answer questions like these, the National Zoo has a bank of mammalian milk, the largest collection of its kind in the country. It includes samples of milk from hundreds of different mammals, from our Zoo and from zoos and research facilities all over the world. Research based upon this milk will eventually help other zoos bottle-feed animals even more successfully, and scientists can study the milk to understand more about the metabolism and growth of wild animals.

Bottle-feeding baby animals, though, involves more than just selecting or creating the right milk formula. Ken Lang, an animal keeper, says figuring out how to bottle-feed animals has been a series of trials and errors, and builds upon an enormous bank of scientific knowledge.

"We use stomach capacity and body weight percentages to figure out the right amount to feed," he

The National Zoo has a bank of mammalian milk, the largest collection of its kind in the country. It includes samples of milk from hundreds of different mammals, from our Zoo and from zoos and research facilities all over the world.

MEGAN MURPHY/NZP



explains. "We calculate everything every day based on the cub's body weight."

In addition to finding just the right formula, keepers and nutritionists have to worry about how to make sure the formula gets into the baby's stomach.

"Although sometimes it looks like you just throw a bottle in the mouth, there's more to it than that," Lang says. "Hand-feeding can be tricky. A lot depends on the temperature of the milk, how well it flows out of the bottle, how well the cub grasps the nipple. For some cubs, you have to hold your fingers on the sides of their mouth to get suction. And they'll get frustrated if the milk isn't coming out properly or if the nipple is clogged."

He says keepers, veterinarians, and nutritionists meet every week (sometimes every day) to discuss the bottle-fed babies and to perfect the process.

"As we tweak the protocol, we get better and better at what we feed, when we feed, and how often we feed."

Of course, the Zoo hopes that it never has to hand-raise many animals. But developing the knowledge and expertise to do so benefits the animals in our Zoo and, by sharing that knowledge, benefits all animals in captivity.

condition. With Nikki, they had a hard time feeling their way through the fat to even find his bones. But, just like humans, animals can't lose weight too rapidly, so Lisi worked with the vets and keepers to lay out a very slow, but steady, weight loss plan for him. They set a target weight based on historical records of what a male Andean bear should weigh. As they slowly inched his weight downward, everyone kept a close eye on how he looked and how he behaved. As he lost weight, he became more active, climbing over the trees and logs in his yard and acting much like an Andean bear would in the wild.

It took more than a year, but Nikki lost a whopping 150 pounds and is finally at what the vets and nutritionists deem his healthiest weight. In fact, Nikki is now too active. He didn't put on as much weight as his keepers would have liked during winter months, and so Lisi had to experiment with his diet, adding different items and amounts, until he was brought to a weight everyone was comfortable with.

The nutritionists, the keepers, and the vet staff do this sort of juggling all the time with each of the animals at the Zoo. "I'm probably changing something in the diet prep books at least daily and often several times a day," Lisi says. "There's a lot of maintenance work to make sure the food is what it's supposed to be and to make sure it's in the right place at the right time."

The Commissary

The logistics are handled by a commissary manager, a food specialist, an administrative assistant, and a team of keepers dedicated to feeding the animals. They're housed in an enormous facility most Zoo visitors don't even know is there. Stretched under parking lot C is the building that comprises the Zoo's commissary. This is where all the food for the animals is received, stored, and prepared.

This gargantuan facility is as clean and organized as the kitchen in any human restaurant, and operates the same way. Many of the keepers even have cooking or

restaurant experience. Deb Grupenhoff, the food specialist at the commissary, used to manage a restaurant for humans.

"We have the same food safety as you'd find in a restaurant. We have the same worries about temperature, sanitation and knives, and keeping meat separate from the veggies," she explains.

Of course, their jobs not only include the sanitary preparation of diets for over three-quarters of the Zoo's residents, but also for acquiring the more than one ton of woody browse (the woody material, including bamboo, provided to the animals in the park) and bamboo required for the herbivores of the park weekly (1,400 pounds of which is for pandas alone). The daily harvest of browse and bamboo is a concrete reminder that the Department of Nutrition is responsible for *every* aspect of feeding and nutrition for the animals at the Zoo (see sidebar "75,000 Pounds of Bamboo," page 15).

Enough Food for Three Months

The Zoo's commissary is much larger than almost any human restaurant, and according to Mike Maslanka, senior nutritionist and head of the Nutrition Department, there is enough food stored in the commissary to feed the entire Zoo animal population for at least three months.

"Everyone might not be happy with what they get," he explains, referring to the animals as well as the keepers, and stressing that the animals wouldn't get all the food variety they're used to. "Some animals might gain weight and some might lose weight. But we'd be able to keep them all alive."

This cache of food protects the Zoo against any sort of meteorological or political crisis that might prevent food deliveries from getting to the Zoo. They have an even bigger stash of some foods, though. For instance, Maslanka prefers to order fish once a year. The fish are frozen right after they're caught and sent immediately to the Zoo. This way they're fresh, and the Zoo knows that they've been frozen and maintained properly.

To house everything, the commissary has two enormous room-size freezers, as well as two even larger refrigerators. A room with humidity control is devoted to ripening



JESSIE COHEN/NZP

Deb Grupenhoff inspects food in the enormous freezer.

bananas. And a room that smells warmly reminiscent of a barn houses all the dry food and biscuits the animals need. The Zoo works with dry food distributors to create just the right kind of food for some animals. But some of it, Grupenhoff explains, like dry dog food for the maned wolves, "We buy off the shelf just like everyone else."

In addition to all of the stored food in the commissary, the Department of Nutrition also stores more than 450 tons of hay in the barns at its campus in Front Royal, Virginia. This, in itself, may not be noteworthy among zoos, aside from the fact that Maslanka is responsible for managing all of the hay which is produced on the grounds of that facility, located in the western Virginia mountains. "Being able to grow all of our own hay is a great fail-safe in the case of a drought year or several drought years in a row," he explains.

Sunrise Deliveries

All of this food is carefully prepared into meals, and placed in bins for each individual exhibit. The commissary keepers then place the bins in bigger plastic totes and deliver them to each animal house every morning, 365 days a year. The keepers start early, often before the sun is up, so that they can be sure the animal keepers have the food when they need it.

In the pre-dawn dark, commissary keepers drive a small fleet of trucks and carts, and drop off totes at each animal house. This includes fresh food, but may also include hay from the hay barn (which some animals, such as elephants and cattle, eat, and others, such as gorillas and orangutans, use as bedding), live fish and worms, and browse. The staff clears away the old totes, and takes them back to the kitchen to be cleaned for use the next day. As soon as the keepers get back, they start all over again—preparing diets for the day, and the one after that.

As keeper Sharyn Hood explains, "Regardless of what happens, everyone has to get fed. We do as much as we can get done in one day. And when we have free time, we start on the work for tomorrow. The pandas don't take a holiday on July 4th. They still want to eat." 

— BRITTANY GRAYSON is a web content editor and science writer for Friends of the National Zoo.



JESSIE COHEN/NZP

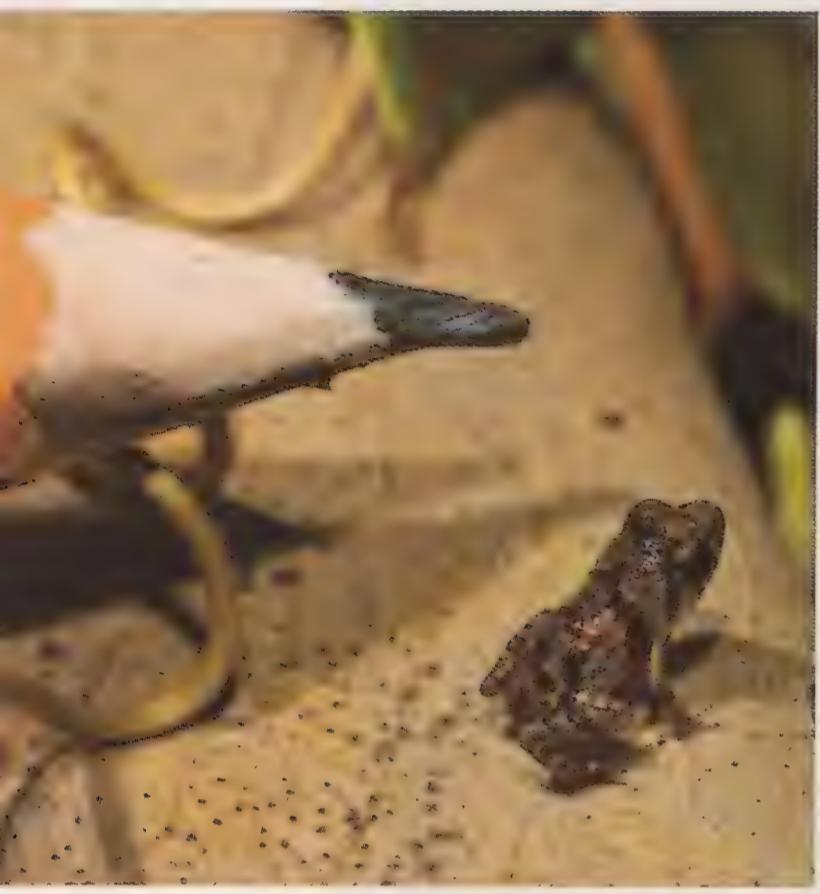
75,000 Pounds of Bamboo

Every animal at the Zoo gets the same attention from the nutrition department; a panda is no different from a salamander. However, some animals are a disproportionate—one might even say giant—amount of work. Giant pandas (*Ailuropoda melanoleuca*), both in the wild and at the Zoo, eat bamboo to the exclusion of almost everything else. However, bamboo is a grass, and it's not particularly high in nutrients. So the giant pandas need to eat a giant amount of bamboo to keep healthy. The commissary feeds the three pandas a total of 200 pounds of bamboo each day.

What's even more impressive is that the Zoo harvests all its own bamboo. Some is grown right on the park grounds. But more of it comes from the Zoo's Front Royal campus and the surrounding area. Harvesting and transporting the bamboo takes the cooperation of the nutrition and the horticulture departments, and is one of the most physically demanding tasks at the Zoo—especially since the Zoo harvests about 75,000 pounds of bamboo every year.

All of that bamboo doesn't go to the pandas, though the lion's share does. Around the Zoo, the Asian elephants (*Elephas maximus*) and the red pandas (*Ailurus fulgens*) both get bamboo as part of their diets. The orangutans (*Pongo spp.*) and the gorillas (*Gorilla gorilla gorilla*) also get a portion of the bamboo, but they don't eat it. They use it mainly for nesting and for enrichment. Mike Maslanka explains, "Bamboo is high in silica, so eating it is like chewing on sand. It's really gritty. For animals that have similar taste and texture sensations as we do, it probably isn't pleasant to eat."

SUPERLATIVE
**Tiniest Frog—
The Greenhouse
Frog**



MEGHAN MURPHY/NZP

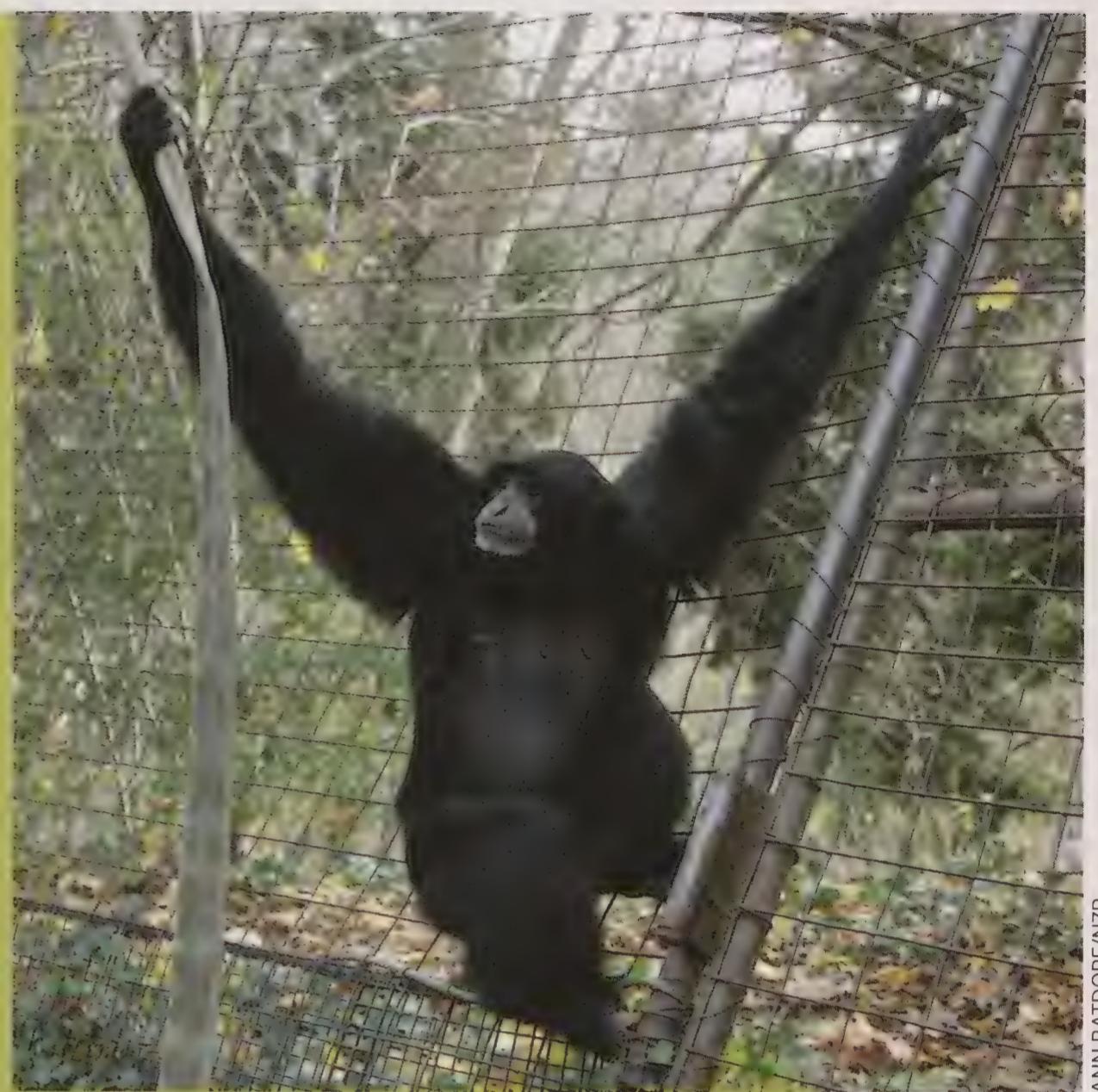
The Zoo's tiniest frog has one of the biggest names. *Eleutherodactylus planirostris*, commonly known as "the greenhouse frog," grows to a whopping 1.25 inches long as an adult, and the babies are only about 5/8 of an inch. "That means a couple of these youngsters could sit comfortably on the nail of your small finger," said Edwin Smith, one of the National Zoo's amphibian biologists. Native to the Bahamas, greenhouse frogs develop differently from your average North American frog. Instead of hatching from an egg mass, swimming underwater as a tadpole, and then emerging on land as a frog, greenhouse frogs come out of their eggs as "frogllets," miniature replicas of their parents. The entire tadpole stage takes place inside the egg. These well-camouflaged, itty-bitty amphibians lay their eggs on land, under moist leaves and other hidden places on the forest floor.

— CAROLINE TREADWAY

DID YOU KNOW?
**Siamangs Soar
Without Wings**

Bats may be the only mammals that can truly fly, but **siamangs** (*Hylobates syndactylous*), the largest of the gibbons, soar through the trees with the greatest of ease! Nicknamed the "kings and queens of swing," these lesser apes are masters at brachiating, a hand-over-hand propulsion technique. With enough momentum, a siamang has the potential to fly between 25 and 35 feet in a single bound!

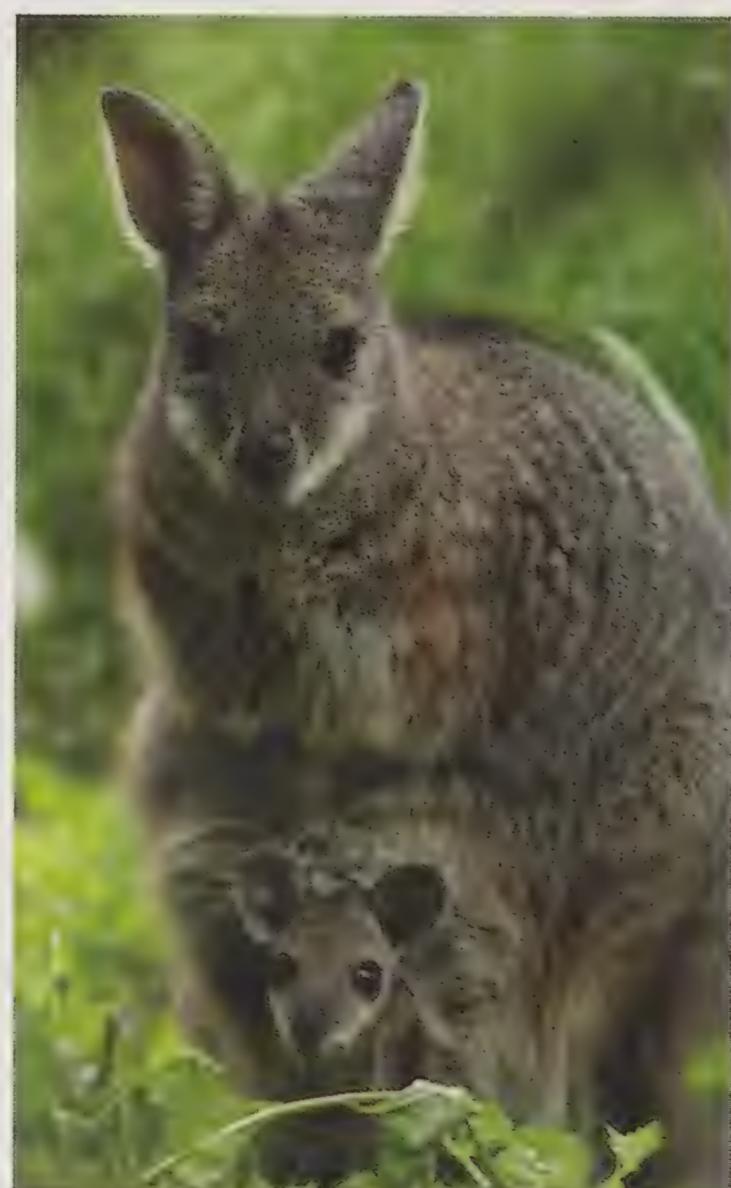
The siamang's long arms are nearly two and a half times the length of its body, perfect for maneuvering through the tropical forests of its native Malay Peninsula and Sumatra. But if a siamang were to descend the tree and walk with its arms to the sides, its hands would drag on the ground! That's why siamangs walk with their arms held high above their



ANN BATDORF/NZP

head, swaying them slightly for balance. On your next visit, come hang out with our siamang pair, Salem and Bradley, at Gibbon Ridge, next to the Great Meadow.

— JENNIFER ZOON



MEGHAN MURPHY/NZP

FACT OR FICTION?
Wallabies Can't Have Twins

Tammar wallaby (*Macropus eugenii*) joeys seldom have to share the spotlight with a twin brother or sister. Twin births are extremely rare. If a wallaby becomes pregnant while her older joey is still nursing, the embryo will pause its development. But as soon as the older sibling stops relying on mom (between nine and eleven months old), the embryo will begin to develop again. This is called "embryonic diapause," or delayed birth, and ensures that each little joey has enough food (and space!) to grow up big and healthy.

Space is especially important, since mom's pouch—a protective skin female marsupials have on their abdomens—isn't built for two. Although it will stretch as her joey nurses and grows, the pouch can become pretty crowded with one joey alone. By the time a joey takes its first steps at eight or nine months, it's half the size of mom!

You don't have to travel all the way to their native Australia to find these cute critters—they're right across from the maned wolves here at the National Zoo.

— JENNIFER ZOON

Where in the Zoo? »

What could this be?

See if you can identify it, then go to
<http://nationalzoo.si.edu/goto/whereinthezoo>
to find out if you were right!



JESSIE COHEN/NZP

Gift Guide for the holidays

It's that time of year again — time to start your holiday shopping! This year, find the perfect gift for everyone on your list at the National Zoo Stores. Whether you're looking for something for the family chef or the wildlife-loving teenager, we've got the gift for you, for him, and for her. Plus, don't miss our great eco-friendly items (look for the ). They are easy on your wallet and the environment.



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KNITTING NEEDLE NECKLACE

- Handmade from recycled knitting needles, this necklace comes on a 16-inch chain. \$80.00



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Made from recycled chopsticks, this folding basket is a great home accent. \$24.00



PLUSH PANDA

This 15-inch giant panda toy is so soft it is difficult to put down. \$16.00



PANDA HOLIDAY CARDS

Beautifully illustrated cards. Box of 20. \$11.00

for kids



MAGIC SCHOOL BUS GOING GREEN SCIENCE KIT

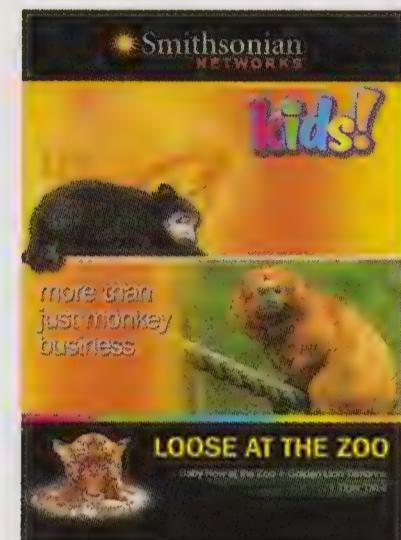
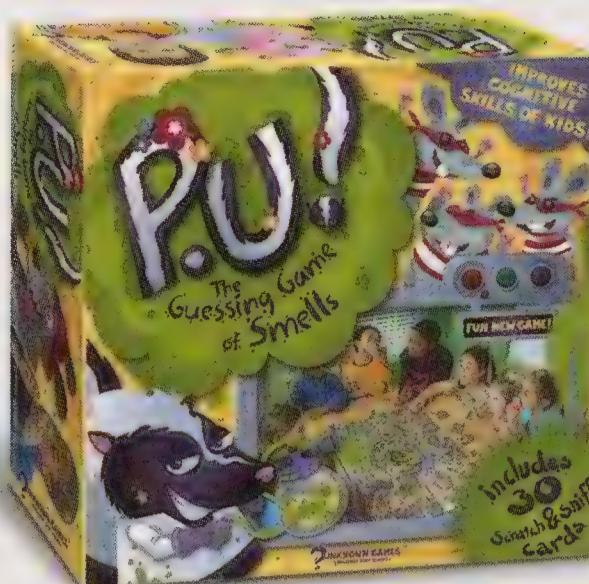
Young scientists can recreate the water cycle, build a compost tube, make packing peanuts disappear, decompose food with fungus, and much, much more. For ages 5+. \$19.99

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Cuddle with this adorable and incredibly soft 12" panda cub. \$14.99



P.U! THE GUESSING GAME OF SMELLS
Smell your way to victory with this unique board game. Ages 5+ \$29.95

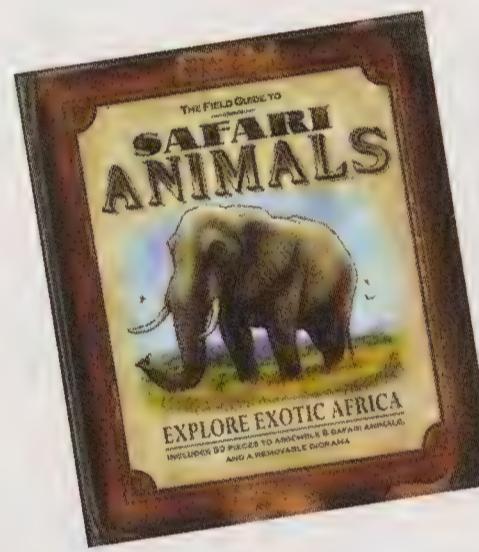


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Take the adventure of a lifetime with this beautifully designed book. Filled with stunning photographs, maps, illustrations, and facts about Africa's most majestic animals. \$15.95



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Tigers Our 16" plush tiger sits so tall while the 12" tiger cub is up to playful mischief. 12" cub \$13.99; 16" adult \$24.00

\$10
and
under



PANDA POO JOURNAL

Made from panda poo, this journal (4 1/4" long x 5 1/2" high) is the perfect gift for panda lovers. \$8.95

Also available in a larger size for \$11.95.



WINE CORK TRIVET KIT

Finally a way to put those corks to use! This kit makes a great gift for wine lovers. \$10.00



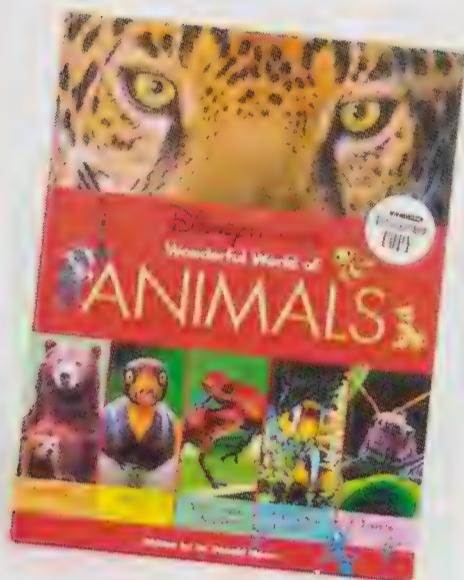
GOOD NIGHT WASHINGTON AND GOOD NIGHT ZOO

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Race around the board to gather food for the National Zoo's giant pandas. Ages 5+. \$19.00



Panda Floppy Plush

This 8" toy is a super soft stocking stuffer. \$6.99

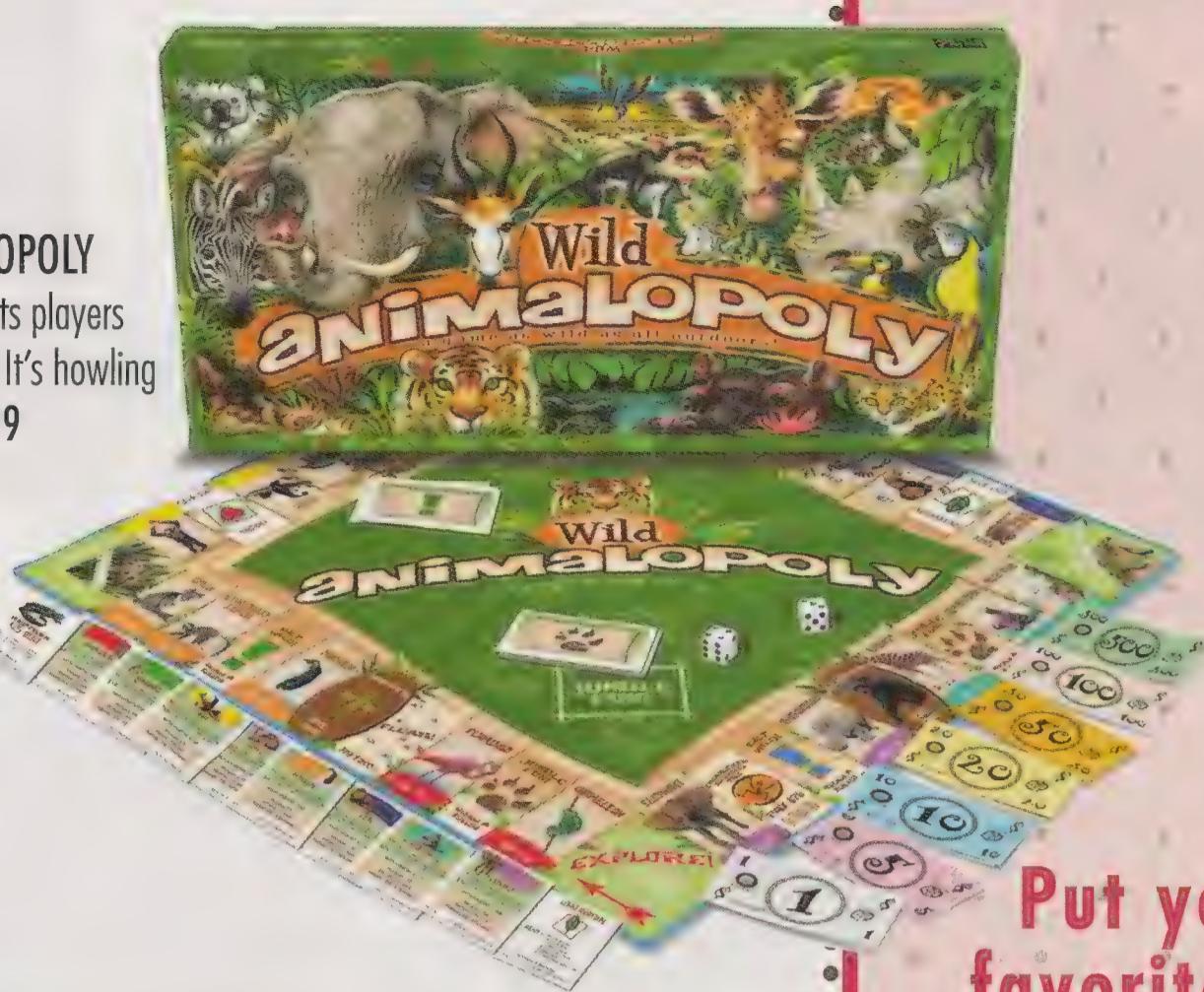


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Two elephants made in fine porcelain sit atop a resin base. The music box plays "Clair de Lune." \$28.50



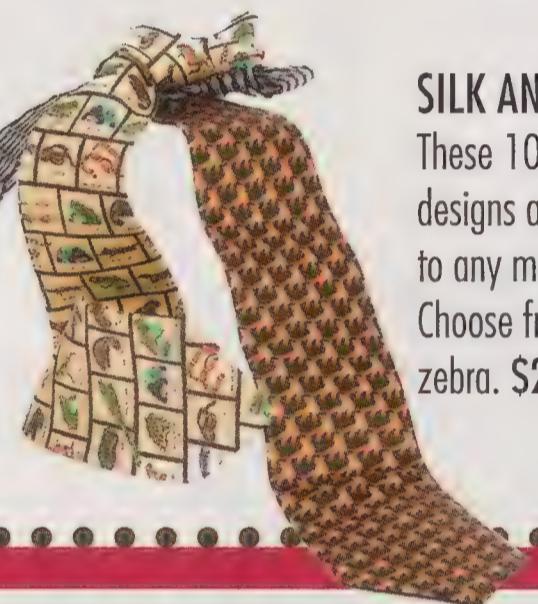
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for him



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Separate your black and white spices with these black and white bears. \$6.00



for
her



LIMITED EDITION PANDA BAGS

Giant panda large tote and messenger bag are made from recycled rice bags. The bags are fully lined with accessory pockets. The rice company has stopped producing this panda design, so quantities are limited. Perfect gift for someone who has everything! Tote \$127.00; Messenger \$82.00



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A sophisticated cotton full-zip jacket embroidered with the National Zoo name and panda image. S-XL. \$42.00



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GIANT PANDA COOKIE JAR

Exclusively ours, this kitchen accessory will delight any panda lover. \$18.00



A Darwin DAY AT THE ZOO

BY DON MOORE

**2009 marks
Charles Darwin's
200th birthday**
and the 150th anniversary
of his defining work, *On the
Origin of Species*. Today's
biologists have great respect
and admiration for Darwin
and his carefully constructed
ideas. His logical presentation
of evolution through natural
selection is the central
organizing principle for
theory and application in
modern biology.

BACKGROUND

Darwin recognized that most species had descended, like varieties of domestic animals, from common ancestors. He noted that species were changeable over time. Darwin also wondered about natural selection before scientists even knew about genetics.

The basis for evolution through natural selection is simple to grasp: First, we know that individual animals and plants show variable differences, and this variability is inherited by their offspring. Second, some animals and plants have particular variations that allow them to survive and reproduce, producing more offspring with similarly winning traits. Each surviving individual produces more offspring than can possibly survive, so the competition among these allows for only "survival of the fittest."

Since the best clue to evolution through natural selection was probably in the artificial selection of varieties of domesticated animals, Darwin focused his work on this subject, and found a clue to natural selection in domestic pigeons, which are descendants of rock doves. Darwin was a recognized expert in pigeon care and breeding, and had breeds as diverse as fantails, carrier pigeons, and pouters. Darwin used the huge diversity of fancy pigeon breeds to represent the artificial selection comparison—arguing this was a domestic model of wild species descending from common ancestors in nature.

A Darwin DAY AT THE ZOO

If Darwin were to visit the National Zoo and give a tour to guests, he would first visit the domestic animals at Kids' Farm, observing the variety in the individual breeds of goats and cows. Darwin said in his book, "Man can and does select the variations (under domestication)...He thus adapts animals and plants for his own benefit." Different cultures through the ages have developed different domestic breeds to adapt to local environments and cultural uses. At Kids' Farm, milk-giving Holsteins and Hereford cows bred for meat production are thought to have been developed from the single primitive species *Bos primigenius*, and the various goat, rabbit, and pig breeds were selected over time from their own wild ancestors.

The variations we see in captive conditions result from a lack of natural selection, which tends to eliminate departures from normal conditions in nature; but humans have selected those variations beneficial to us—for beautiful coloration, and for milk, protein, and fiber production. In contrast to the highly diverse species of goats and cattle at Kids' Farm, Darwin remarked on the lack of diversity in species like donkeys by acknowledging the lack of artificial selection when he said, "In donkeys, from only a few being kept by poor people, and little attention is paid to their breeding." Visitors can see the different colors in the donkeys living at Kids' Farm, but unlike cow breeds developed for other uses, the donkeys are similarly sized and shaped, and are more similar to one another and to their wild ancestor.

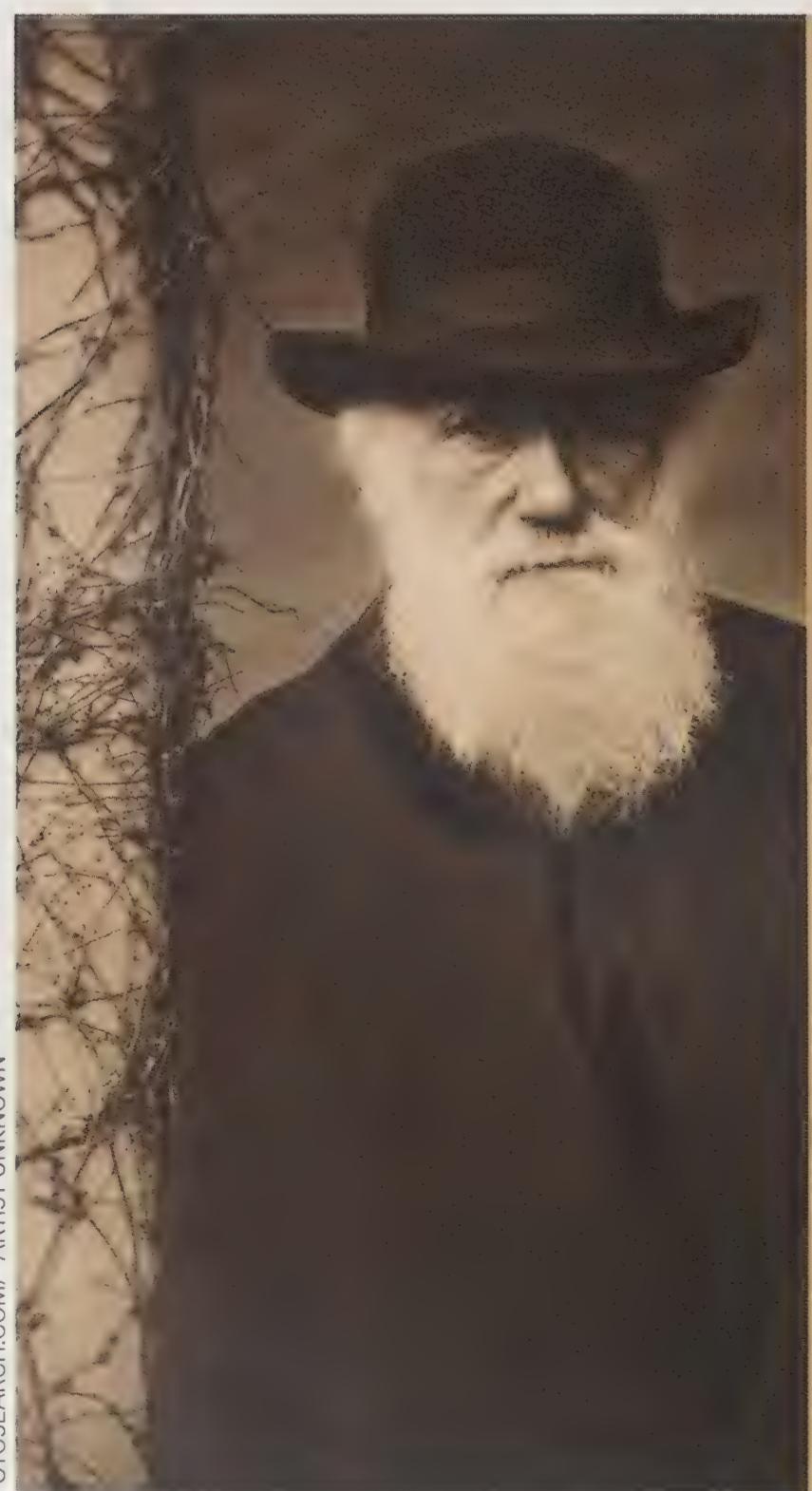
On to Amazonia — Identifying Frogs

Darwin noted that individual animals in nature differ slightly from their parents, just as humans do. Take the example of the poison dart frogs, which can be identified by the different patterns on their backs. Darwin would most certainly ask the Amazonia staff to show dart frogs on the tour, so visitors could see the individuality—such as varying skin patterns of young dart frogs changing into adults—to compare these to the adult parents. Darwin recognized that the variety a select group of similar individuals might develop could become the intermediate varietal from which a new species might develop. He said, "Thus, the forms of life throughout the universe become divided into groups subordinate to groups."

Next Stop — Reptiles & Inverts

Darwin's next stop in his tour of the Zoo would most likely be the Reptile Discovery Center and the Invertebrate Exhibit. Species housed in these exhibits illustrate the concept he learned from Malthus' 1838 *Essay on the Principle of Population*, which emphasized one general principle of nature—that living creatures produce more offspring than can possibly survive to be mature, to become reproducing organisms themselves.

Before he entered the Reptile Discovery Center, however, Darwin would probably stop at an oak tree and pick up some acorns from the ground to show us that the strategy of producing many offspring applies to plants as well as animals. Outside the reptile house, he would show visitors the huge, natural school of tadpoles found in the pond each spring. Of these hundreds of tadpoles, only a few will survive to the age when they can mate and produce other tadpoles that will grow into adult amphibians. Amphibian survival, of course, depends upon the amount of available food, available habitat, and diseases like the chytrid fungus, currently devastating populations around the world. Sometimes, Darwin would suggest, even



FOTOFORCE.COM/“ARTIST UNKNOWN”

All About Darwin

Charles Darwin was born in Shrewsbury, England, in 1809. His father was a doctor, and his grandfather Erasmus Darwin was both a doctor and an evolutionary theorist himself. Darwin's mother was the daughter of Josiah Wedgwood of pottery fame. Darwin attended Edinburgh University and Cambridge. While at Cambridge, he began working with John Stevens Henslow, a famous professor of botany who helped a 22-year-old Darwin join the discovery ship H.M.S. *Beagle* on its five-year circumnavigation of the world. In his autobiography, Darwin wrote of the 1831-1836 cruise as the ship's "gentleman's naturalist," and said "The voyage of the *Beagle* has been by far the most important event in my life and has determined my whole career...I have always felt that I owe to the voyage the first real training or education of my mind. I was led to attend closely to several branches of natural history, and thus my powers of observation were improved."

Darwin read and applied Charles Lyell's *Principles of Geology* during the voyage, and was able to think deeply about the age of life, how fossils that he found during the voyage gave evidence for the great age of life, how animals he observed on different continents could be related given the great length of geologic time, and other evidence which would then allow him to make a clear and logical case for his great theory of evolution via "descent through modification" (which we now call "natural selection"). From 1832 through 1834, the *Beagle* remained in the southern cone region of South America, and the great diversity of life there helped Darwin to form many of his later views.



JESSIE COHEN/NZP



MEHGAN MURPHY/NZP



ANN BATDORE/NZP



MEHGAN MURPHY/NZP

the “fittest” will not survive this type of great environmental change.

Huge reproductive potential is also observed in the millions of fertilized eggs produced by corals in the Invertebrate Exhibit. Only a few of these will survive to settle and grow into polyps. In the wild, the rest die due to current environmental conditions, or may be eaten by voracious predators.

Adaptations in Small Mammals

Darwin would next lead us to the Small Mammal House to examine the concept of adaptations. Small mammals have an incredible diversity of form and function, and the Zoo has small mammal examples from around the world. The two-toed sloth (*Choloepus didactylus*) is a great example from South America, with its adaptations of strongly recurved claws for moving around trees and slow movement that assists with camouflage against predators. Black and rufous giant elephant-shrews (*Rhynchocyon petersi*), with their strong back legs used to escape predators, and long, mobile noses for finding insect food, are cartoon-like examples from Africa. And Prevost’s squirrels (*Callosciurus prevosti*), with their adaptive camouflage coloring and balancing tails, are great examples from Asia.

Darwin recognized potential criticisms of evolution based on natural selection alone, and developed an extension of his

theory to “sexual selection.” Acknowledging that there could be differences between the sexes in behavior or in physical structure, he said, “This form of selection depends not on a struggle for existence in relation to other organic beings or external conditions, but on a struggle between the individuals of one sex, generally the males, for the possession of the other sex.”

Darwin’s tour has included his main theory about evolution, which explains the diversity of life on Earth. How would this great writer end his Zoo visit? He might just fade away, leaving visitors to observe the adaptations of different animals, to think about what adaptations their long-ago ancestors had, and to speculate about what their descendants might look like far in the future.

CLOCKWISE FROM TOP LEFT: A strawberry dart frog (*Dendrobates pumilo*); San Clemente Island goats (*C.h.h. san clemente*); a Holstein cow (*B.t.t. Holstein*); and black-and-rufous giant elephant shrews (*Rhynchocyon petersi*).

However, he would be especially pleased if the tour continued to include the animals he found while on the H.M.S. *Beagle*’s voyage around the world—giant tortoises and other island giants, flightless rheas, long-legged maned wolves (*Chrysocyon brachyurus*), armadillos (*Tolypeutes matacus*) and giant anteaters (*Myrmecophaga tridactyla*)—all found at the National Zoo.

Darwin had keen insight, and was a thoughtful writer who was able to put forward his theory of evolution in a way that captured the imagination of the world. His great contribution to the view of life still drives discoveries in biology and medicine. He would have loved visiting the National Zoo to observe the many animals he used as examples for his revolutionary theory of evolution. ■

DID YOU KNOW ?

“Theory” in everyday language means a hunch or speculation. A “Theory” in science, like the Theory of Gravity, the Theory of Relativity, and the Theory of Evolution, in contrast, has so much supporting evidence from observation and experimentation that it becomes an established scientific explanation.

— DON MOORE is the associate director of animal care at the National Zoo. He is also an accomplished writer and author of a successful children’s book.

After decades of poaching, civil strife, and habitat degradation, small populations of the red-necked ostrich subsist in only a few isolated places. Smithsonian's National Zoo scientists are engaged in an all-out effort to save them.

BACK FROM THE BRINK

BY HARVEY LEIFERT



JOHN NEWBY/SAHARA CONSERVATION FUND



BACK FROM
THE BRINK





JOHN NEWBY/SAHARA CONSERVATION FUND

Visitors to the National Zoo search in vain for ostriches. For more than a decade now, the world's largest birds have been absent from the Zoo. Their former enclosure is currently home to kori bustards (*Ardeotis kori*), the largest birds that can fly. But does that mean the Zoo is not interested in ostriches?

Quite the contrary. Zoo staff members, starting with Acting Director Steve Monfort, are engaged in an all-out effort to save a critically endangered race of ostriches from extinction. A century ago, the red-necked ostrich (*Struthio camelus camelus*) roamed Africa's Sahara and Sahel regions, ranging across the territory of more than a dozen present-day countries. Today, however, after decades of poaching, civil strife, and degradation of their habitat, small populations of this bird subsist in only a few isolated places. In Niger's Aïr (pronounced ah-EER) Mountain region, where they were once abundant, not a single wild ostrich remains, and that is also true for the country as a whole.

A History of Unrest and Drought

Aïr in northwestern Niger is part of Africa's largest protected area, covering 40,000 square miles, and is a UNESCO World Heritage site. The Aïr Mountains themselves are a unique geological feature, comprising nine circular massifs. The mountains channel occasional rainwater (about three inches per year) to the plateau below, which includes a number of oases. This green area in the middle of the Sahara has long been a magnet for birds and other wildlife, but many animal species in addition to the ostrich, such as the dama gazelle (*Gazella dama*), are now threatened or critically endangered there.

Niger's ostrich population suffered severe collateral—and intentional—damage during an anti-government rebellion of Tuareg nomads during the early 1990s. An estimated 1,500 birds, the last of Niger's wild ostriches, were slaughtered. A drought in the 1980s

had disrupted the Tuareg's traditional way of life, and they felt that the government had diverted international food aid, intended to assist them, to other uses. Also, traditional trading routes across the Sahara had been disrupted, and tourists stopped coming, further exacerbating the economic crisis.

Saving the Ostriches

Conservation-minded villagers from nearby Iférouane were able to rescue just a dozen of the birds, which they brought to holding pens in their town. These are among the estimated 70 captive adult red-necked ostriches in Niger now, which also include some birds brought in from neighboring countries.

The effort to save the red-necked ostrich is directed by the Sahara Conservation Fund (SCF), an international nonprofit organization in which the National Zoo is a key participant. Monfort was one of SCF's founders and is its chair. SCF was created in 2004 and began its Niger ostrich project the following year, in direct response to a request from conservationists in Iférouane for help. Recognizing that all of Niger's ostriches are now in private hands, SCF has worked closely with their owners to achieve a sustainable future for the birds.

Enter National Zoo biologist Sara Hallager, who serves as chair of the Association of Zoos and Aquariums' Taxon Advisory Group (TAG) for ratites, the family of flightless birds that includes ostriches. The TAG, she says, provides tactical and husbandry advice to Niger, a country with limited resources. In 2008, Hallager participated in a field trip to

The red-necked ostrich (*S.c. camelus*) is one of four living races of ostrich, a fifth one having gone extinct in the mid-20th century on the Arabian Peninsula. The most common race is perhaps *S.c. australis*, which thrives in South Africa, Botswana, and Namibia and is extensively farmed in southern Africa and as far away as Arizona. The others are Somali (*S.c. molybdophanes*), found in the Horn of Africa, and the Masai (*S.c. massaicus*) in East Africa.

Niger to individually identify as many of the captive birds as possible. On the trip, Hallager was accompanied by staff members of the St. Louis Zoo and Disney's Animal Kingdom, active participants in the project, and they were joined on-site by Nigerien conservation officials.

Blood samples are the preferred source of DNA for analysis, says Hallager, although feathers and fecal samples can also be used if you are sure that you know which bird is their source. How do you get an ostrich to hold still, in order to take a blood sample? If one is in a small enough pen, says Hallager, you just grab on, preferably with lots of helpers, until the veterinarian can insert a needle. The ostrich is, of course, determined to get away from the crowd of hangers-on, making for some tense moments, as these nine-foot-tall, 300-pound birds can unleash a powerful kick. "They can kill a lion," she notes.

"It was scary," concedes Hallager, "but I had the easy job. I just put the hood over the ostrich, while the big guys restrained it. Basically, you herd the ostrich into a corner, and then there's a hook you can put around the neck to pull it in, and at that point everyone kind of piles on. Yeah, it's dangerous! But, amazingly, nobody got injured, other than some scrapes."

"The birds we couldn't get our hands on were in a very, very, very large pen, and those are the birds we ended up getting fecal samples on; we just couldn't catch them." Ostriches, she notes, can run at 40 miles per hour or more.

The final step in the identification process was to attach a transponder to as many of the captive birds as possible so individuals can easily be located later for mating purposes. Unfortunately, not all of the tested birds wear transponders, Hallager says, because some of the devices were in baggage that never arrived in Niamey, Niger's capital.

DNA information is essential to organizing a breeding program, said Jon Ballou, a specialist in population genetics. The next step, he says, is to create "a computer dating service" for the ostriches, based on

a listing all of the birds from which DNA samples were taken, a so-called stud book. Then scientists can begin devising ideal match-ups.

Robert Fleischer, who heads the Zoo's Center for Conservation and Evolutionary Genetics, says that two questions were paramount. First, which birds are pure red-necked ostriches and which are hybrids (as the various races can interbreed)? Second, which birds are closely related, running the risk of inbreeding?

As it turned out, all DNA samples collected in Niger were from pure red-necked ostriches; none had been hybridized. This, Fleischer says, greatly eases the logistics of



JOHN NEWBY/SAHARA CONSERVATION FUND

The effort to save the red-necked ostrich is directed by the Sahara Conservation Fund (SCF), an international nonprofit organization in which the National Zoo is a key participant.

the breeding program. As for the second question, some captive birds proved to be siblings of other birds held far away, in other pens. He believes that these birds must have been given or sold by their owners when they were still chicks. The DNA database will assure that no siblings are mated simply because they are currently located far from each other. Ballou and his computer dating program will recommend matches, seeking to develop the strongest possible gene pool.

A team of biologists will visit Niger during the winter of 2009-2010 to begin moving selected birds and improving the infrastructure at Kellé, a key holding site in southeastern Niger. Although it is surrounded by mountains, fencing is required in some areas, and what is there now, Hal-

lager says, is in some places just a few sticks. Fortunately, a recent donation to SCF of four kilometers of high tensile steel game fencing will mitigate that problem.

Under the breeding program, half of the chicks will be retained by the owner of their parents and half will go to SCF, which can move them to other sites to prepare for the next generation of matches. Some eggs might go abroad to zoos, to spread out the population geographically, as protection in case of a natural disaster, epidemic, or renewed unrest in Niger or neighboring countries.

Fertilized ostrich eggs can be flown to the U.S. in special insulated cases for

hatching here, says Monfort. The chicks can then be dispersed to various zoos and even back to Niger. Ostriches are prolific breeders. "With a couple of females, you can have a hundred eggs in a year. You can get the numbers up pretty quick with this kind of program," says Hallager.

"The ultimate goal is the reintroduction of the Nigerien ostrich," says Hallager. "It's going to take a massive education campaign," she adds. "Lots of people think that ostriches are still living wild in Niger," unaware of the massive poaching that took place during the 1990s. "It's also going to take long-term monitoring." Realistically, she says, there will always be some poaching, but the scientists hope that with a nationwide campaign, the Nigerien government and SCF will be able to educate people and reduce that risk.

Ostriches at the National Zoo

Of course, the National Zoo would like to have ostriches again at some point, says Monfort, and especially, the now-rare red-necked race. But ostriches are not likely to find a new home at the Zoo until the planned renovation of the Bird House is completed, around 2016. Some birds may, however, be raised at the Zoo's Front Royal, Virginia, facility before then.

The Zoo's Bird House project is third in line after completion of the Elephant Trails exhibit, currently in progress, and

construction of a new seal and sea lion facility, says Monfort. "The Bird House is a historic structure," he notes. "It won't be demolished and rebuilt; it will be renovated and refined and upgraded." It will be an opportunity to better explain the life stories of birds, including the large flightless ones, like the red-necked ostrich, he adds. "It's not just that we have, or want to have, red-necked ostriches, but that we're actually taking a leading role to study and understand the plight of the species."

"But," he acknowledges, "it's harder to make the case for an animal that you don't have in your zoo. You need to meet the visitor's expectation. They're here to have fun. They want to see animals—and that's your entry point. Having pandas is a fantastic draw for us, having elephants, having other species—it's how you begin the conversation, really, about wildlife and about animals," he says.

The Zoo's bird collection will be "dramatically improved" in the next five to ten years, says Monfort. The renovation project will cost some \$30 million from the federal government's grant for capital improvements, says Monfort, but that does not include funds for outfitting the exhibits with interpretive materials, horticultural elements, and other materials, so a major fundraising component will complement the physical renovation project.

The Zoo is fortunate to have a wealth of extremely talented staff and inspirational champions for the species they are working with, says Monfort. "People like Sara Hallager, I think, represent the very best of what our profession has to offer, with respect to an animal care professional—someone who goes way beyond the simple acts of taking care of an animal." Through passionately championing a species, the Zoo's staff members can inspire others to want to support them, he says. "They make things happen."

Hallager works from a small office, festooned with photos of birds, in the basement of the Bird House. But living birds are just outside her door. A parrot, isolated to check for possible disease, calls out frequently. Nearby, a staff member from the Atlanta zoo nurtures newly hatched kori bustard chicks, preparing herself to care for birds her zoo will soon acquire.

some cases, they are status symbols for their relatively wealthy owners.

John Newby, CEO of the Sahara Conservation Fund, reports, "We have just finished our first trial year using a new incubator. Working with local ostrich owners, we are now set to make substantial improvements in their capacity to breed and raise ostriches, a significant part of

which will go into developing breeding capacity for reintroduction projects, in Niger to begin with. To accompany the plans to increase production, we are also raising funds to improve infrastructure, breeding pens, and food rations."

Just as the ostrich project evolved from the SCF antelope project, notes Monfort, the ostrich project has awakened interest in saving other Sahelo-Saharan animals, including cheetahs, foxes, African wildcats, and jackals. "They're all in the middle of nowhere, in a place most people would say is a barren wasteland," he says, "but now that we have demonstrated that these species are there, we have attracted people who want to do carnivore studies, bird studies, antelope studies, and we're establishing the largest protected area in the world in Niger, 40,000 square miles." The reserve is being established with the cooperation of the Niger government and nomadic groups who use the same land for grazing their herds of cattle.

As for the red-necked ostrich, Fleischer notes that the DNA samples collected in Niger suggest that it may actually be a separate species, not simply a race of *Struthio camelus*. That would, he notes, raise its nine-foot profile even higher among conservationists and others devoted to wildlife conservation. □

— Freelance writer HARVEY LEIFERT has travelled and written extensively about life and the animals in Africa.



Sara Hallager works extensively with kori bustards at the National Zoo. They are the largest birds that can fly.

MEGAN MURPHY/NZP

The Conservation Message

Regarding red-necked ostriches, Hallager says that it is often difficult to get across that today there are exactly zero ostriches living in the wild in Niger. Many Nigeriens believe that flocks of ostriches still populate the vast desert areas of their country, but in fact, all of Niger's living ostriches are captive birds. They are raised for meat, feathers, and hide. In



Sweat Like a PIG?

Meet the wild, "pig-like" animal — the javelina or peccary.

BY PAMELA BUCKLINGER

STUCK IN THE MUD » Javelinas (have-uh-LEEN-ahs) are wild, pig-like animals found in the southwestern United States, Central America, and South America. The name "javelina" is Spanish for javelin or spear—a good name for these animals with razor-sharp teeth. A white necklace of hair gives javelinas another name: "collared" peccaries. They have big heads, long snouts, and super stiff hair—no need for hairspray!

SWEAT LIKE A PIG? » You've heard it before, but it's just not true: Pigs don't sweat! Peccaries stay cool by living close to water where they can wallow in the mud during the hottest part of the day.

They are very active (usually when it's cooler at the beginning and end of the day), but they are definitely not sticks in the mud!

PIGGIN' OUT » Javelinas' favorite foods include roots, fruits, and seeds and, in desert areas, cactus. They also chomp on insects and other small animals. Javelinas have poor eyesight, so they use their powerful noses to smell their way to dinner. When they find yummy roots underground, they use their sharp tusks to dig them up and eat them. Most of the time they do not have to drink water because they eat juicy plants that are like food and drink built into one.



JESSIE COHEN/NZP

PEEEE-YUUU! WHAT'S THAT

SMELL? » You may smell a peccary before you see it! Peccaries have a large scent gland, or smell maker, on their rumps. Instead of being known by their faces, these animals each produce a unique smell that is recognized by other members of their group. This smelly method helps groups stay together. Being stinky can come in handy.

CONSERVATION CORNER » Farmers often think peccaries are pests because they dig up and eat crops. Although they are not endangered or threatened, biologists are watching their populations because as more and more land is cleared for humans, there is less room for peccaries.

AT THE NATIONAL ZOO » Get the real dirt on javelinas (peccaries) by visiting the three that call the Zoo home. Look for them next to the Small Mammal House, where they dig, root, wallow, and go hog wild!

Pig Out Peccary Style!

The peccaries at the Zoo love to munch on sweet potatoes. You can too! Make the recipe below and eat like a king (or a pig)!

Sweet 'n Sassy Sweet Potato Pockets

vegan; makes eight

- 2 pita pockets, soy or whole wheat flour preferred
- 2 cups Kathy's Sweet Potato Mash (ingredients below)
- 1/2 cup Cran-Citrus Chutney (ingredients below)
- 1 tub garlic hummus
- fresh black pepper
- cayenne and thyme
- mixed greens
- olive oil

Pitas

- 1) Brush with olive oil, sprinkle with a pinch of fresh thyme, and slice into quarters. (8 total from 2 pitas)
- 2) Warm in oven for ten minutes at 300 degrees.
- 3) Heat until softened on inside and edges are crisp.



Pita Assembly

- 1) Open pita gently and add the following:
- 2) Spread 1 tsp garlic hummus
- 3) Spoon 2 Tbsp Sweet Potato Mash
- 4) Spoon 1 Tbsp Cran-Citrus Chutney
- 5) Add a few leaves of mixed greens; squeeze pita tip to close

BEFORE SERVING:

Re-toast in 350 degree oven for ten minutes. Serve warm.

STORAGE:

Store in fridge until ready to eat. Re-toast in oven. Or microwave gently for a soft pocket.

Sweet Potato Mash

(slightly modified from original recipe)

- 1 large garnet sweet potato (about 3 cups), baked
- 1 cup Vidalia onion, chopped
- 1 large carrot, slivered half-rounds
- 1/3 cup garlic hummus
- 1 Tbsp olive oil
- 1/4 cup fresh tangerine juice
- 1 1/4 cup parsley, chopped
- 2 Tbsp maple syrup, dark grade A
- 1 sprinkle cayenne
- salt/pepper to taste

Add more cayenne for even more "sassy" spice.

To add a crunchier texture, mix in chopped celery.

Cran-Citrus Chutney

- 1/2 can cranberry sauce
- 1 tangerine or orange, peeled and cubed
- 1 Tbsp tangerine or orange juice
- 1 dash of fresh black pepper

Mix well by folding ingredients with fork.

Recipe courtesy of Kathy Patalsky.

The Nutrition?

Nutrient pockets is what these pitas should be called! They are high in fiber and vitamin A-rich sweet potatoes, heart-healthy garlic, protein-rich hummus, healthy grains in the pita and a dose of super-fruit chutney with cranberries and citrus. And there's even a dose of nutrients from the parsley and mixed greens.

The flavors? Think Thanksgiving-esque with a kick.

BY GABY GOLLUB



[RESEARCH REPORT]

EXTREME MAKEOVER:
Cuttlefish Exhibit

If you've ever seen the reality TV show *Extreme Makeover: Home Edition*, you're familiar with the premise that a family that has endured a hardship can be greatly helped when their home is renovated. The National Zoo's common cuttlefish (*Sepia officinalis*) haven't faced any major hardships, but a team of Zoo staff recently carried out a pilot study to see how an exhibit makeover for three of the Invertebrate Exhibit's cuttlefish might alter their lives.

Much research has been conducted on the color-changing and cognitive abilities of the common cuttlefish, mollusks in the same class as squid, octopuses, and nautiluses, but not much is known about the effects of different management techniques. We know they can change color instantaneously for camouflage, defense, communication, and to distract prey, and experiments have shown that they are capable of solving mazes and spatial learning. But when it comes to what sorts of features in a tank might change their behavior, little is known.

The Zoo's Extreme Makeover: Cuttlefish Edition team, comprising the curator of enrichment and training, curator of invertebrates and education, two other members of the animal-care staff, and an intern, developed four goals that a more enriched environment might achieve. The goals were reducing what are believed to be stress-related behaviors such as inking and jet-slammaing, enabling multiple cuttlefish to be kept in a tank together for an extended time, increasing species-typical behaviors, and enhancing the visitor experience by encouraging the cuttlefish to exhibit more behaviors and diverse body patterns.

To determine what kinds of enrichment strategies might be most effective, the team first educated itself about the cuttlefish's natural behaviors. As one example, the knowledge that cuttlefish spend a lot of time on the bottom led to the decision to concentrate a lot of the enrichment features on the bottom of the tank. Next, the team generated a list of enrichment categories and then narrowed it down to exhibit furnishings, air bubblers and currents, and substrates for the pilot study.

The study focused on three cuttlefish—two that were housed together, and one that lived with several chambered nautiluses. To learn how the makeover affected the animals' behavior, the team members observed them for dozens of hours. They gathered data before the makeover, when the tanks had one substrate spanning across the bottom of the tank and a few rocks, and after the makeover, when the enriched exhibits had seven substrates, artificial plants, real and fake rocks, fake coral, air bubblers, and an artificial wood tunnel.

At one-minute intervals, they recorded a variety of data about each animal, including its behavior (was the animal stationary, partially buried, swimming, hunting?), its body pattern (was it uniformly light or dark, mottled, changing?), texture of its skin, the animal's location in the tank, whether it was in contact with any enrichment items, and even how many visitors were nearby.

The team found that, overall, the cuttlefish had more active behaviors (and spent less time resting on the bottom) in the enriched tanks. Their behavior was not altered by any particular substrates or features — they were more active in response to the variety. While Heidi Hellmuth, the Zoo's curator of enrichment and training, stressed that this was the pilot study and major conclusions should not be drawn from it, "it does help us gain more information to help us continually strive to improve the care of this species."

MEGAN MURPHY/NZP



MEGHAN MURPHY/NZP

Elephant Trails 2008 Annual Appeal Update

Thanks to the support of generous friends and members, FONZ raised more than \$225,000 for the Exercise Trek in the National Zoo's Elephant Trails exhibit. The Zoo extends its sincere gratitude to everyone who helped make this wonderful gift possible.

To help protect the future of Asian elephants, the National Zoo launched Elephant Trails: A Campaign to Save Asian Elephants. The comprehensive breeding, education, and scientific research program is designed to help care for elephants in zoos and save them in the wild. A major part of this project is a new state-of-the-art home for the Zoo's elephants. Based upon a long history of research and caring for elephants, the new exhibit will include many innovative features including the Exercise Trek. Phase one of Elephant Trails opens soon, and the rest of the exhibit is scheduled for completion in late 2011.

Donors who made gifts of \$100 or greater will be recognized on the Elephant Trails display in the Visitor Center lobby. Donors who made gifts of \$500 to \$10,000 will be recognized in the 2008 FONZ Annual Report. Donors who are entitled to bricks and footprints will be contacted in early 2010 for inscription information.

Thank you once again to all who supported this important project.

Check this FONZ section in each issue of *Smithsonian Zoogoer* for important member news about Zoo events, classes, camps, and more.

For more information, visit www.fonz.org.

FONZ Resources

Membership information
202.633.2922

FONZ special events
202.633.4470

Development office
202.633.3033

Camps and classes
202.633.4470

Volunteer services
202.633.3025

Comments? Questions?
Please email us at
member@fonz.org

Not a FONZ member yet?
Call 202.633.3034
or go to
www.fonz.org/join.htm

FRIENDS OF THE NATIONAL ZOO PRESENTS **WILD SIDE STAGE** A PERFORMANCE SERIES FOR CHILDREN

Live shows, great performers! Fun for the whole family. Sundays beginning January 10, 2010. Learn more at WWW.FONZ.ORG/WILDSIDESTAGE.HTM.

FONZ CLASSES

ADULT/CHILD CLASSES »

These programs are designed to allow adults and children to discover the Smithsonian's National Zoo together. All children must be accompanied by an adult. For the safety and enjoyment of everyone, unregistered children and siblings may not attend—with the exception of infants who are not yet crawling.

Children's classes and programs are open to FONZ members at the Household level and higher categories only. All classes meet in the Visitor Center unless otherwise noted.

Register online at:
www.fonz.org/classes.htm.

Colorful Critters

Meet some of the most colorful animals at the Zoo while singing songs, making crafts, and learning about their role in the big world!

AGES 2-3 (with an adult)
DATES SESSION 1: November 2, 9, 16, 30; December 7
SESSION 2: November 3, 10, 17; December 1, 8
SESSION 3: November 4, 11, 18; December 2, 9
SESSION 4: November 5, 12, 19; December 3, 10
SESSION 5: November 6, 13, 20; December 4, 11
TIME 10-11:30 a.m.
FEES \$100

MEHGAN MURPHY/NZP

Lifestyles of the Small and Furry

These animals may be teeny, but that doesn't mean they aren't tremendous fun! Meet the Zoo's small mammals and learn why great things come in small packages.

AGES 2-3
DATES SESSION 1: November 14
SESSION 2: November 15
TIME 10-11:30 a.m.
FEES \$25

Zoo Crafts

You and your child will have zoodles of fun making original animal-themed crafts for the holidays. Taught by an animal artist, you will make everything from wildlife ornaments to animal-print cards and your very own wrapping paper.

AGES 3-5 (with an adult)
DATES SESSION 1: November 19; December 3, 10
SESSION 2: November 20; December 4, 11
TIME 1-2:30 p.m.
FEES \$65

Spots and Stripes

Bold prints are always in season at the National Zoo and our animals come in a variety of colors and patterns! Learn about and meet some of the Zoo's best dressed animals. Please don't be fashionably late!

AGES 2-3
DATES SESSION 1: December 5
SESSION 2: December 6
TIME 10-11:30 a.m.
FEES \$25

CHILDREN'S WEEKEND WORKSHOPS »

Children's workshops are for kids ages 4 to 14. Specific ages are indicated in each class listing. Parents are not encouraged to stay with the class, but may if they wish. There is no charge for an adult who attends with a child.

Panda-mania

Learn why we roll out the red carpet for these black-and-white bears through hands-on activities, crafts, and a visit to the Panda House. Come see what all the fuzz is about!

AGES 3-5 (with an adult)
DATES SESSION 1: November 7
SESSION 2: November 8
TIME 10-11:30 a.m.
FEES \$25

Cheetah Conservation

Did you know that a cheetah can reach a speed of 45 miles per hour in less than three seconds? In this high-energy class, challenge yourself and see how humans compare to the world's fastest land animal. You'll also find out what scientists are doing to help this endangered cat in its race for survival.

AGES 6-9
DATE November 14
TIME 10 a.m.-noon
FEES \$28

MEHGAN MURPHY/NZP



Feast for the Beasts

Have you ever thought about what you would serve a hungry hyrax or famished flamingo if it showed up for supper? Learn all about the fancy feasts we prepare for some of our Zoo animals and see for yourself when you go behind the scenes at the commissary!

AGES 4-5
DATES SESSION 1: November 21
SESSION 2: November 22
TIME 10 a.m.-noon
FEES \$28

Thanksgiving Feast

Our animals have a lot to be thankful for! Here at the National Zoo, top animal nutritionists work hard every day in the commissary to make sure our residents have plenty to feast on. Come find out what our animals eat, learn about the science that is used to develop their diets, and take a frigid fieldtrip through the freezers. Bundle up for a behind-the-scenes tour and get ready to sink your teeth into some fun!

AGES 6-9
DATE November 21
TIME 10 a.m.-noon
FEES \$28



Rockin' Reptiles

Hissing snakes, splashing crocs, and leaping lizards can make for a noisy crowd. Investigate the reptile world while creating your own rockin' reptile music!

AGES 4-5
DATES SESSION 1: December 5
SESSION 2: December 6
TIME 10 a.m.-noon
FEES \$28

Subzero

Come chill out at the National Zoo and explore what it takes to live in the coldest places on Earth! Whether they require extra body blubber or are fitted with the finest fur, animals adapt to these extreme environments in amazing ways!

AGES 10-12
DATE December 12
TIME 10 a.m. - noon
FEES \$28

Zoo Vet

Can you imagine what it takes to care for a giant elephant or slimy salamander? Zoo veterinarians have one of the toughest jobs around. Bring a fluff-filled friend to practice your veterinary skills on while learning how we care for the animals at the Zoo!

AGES 4-5
DATES SESSION 1: December 12
SESSION 2: December 13
TIME 10 a.m.-noon
FEES \$28

HOME EDUCATION CLASSES

CLASSES >> These programs are designed for children educated in a nonschool setting. They are interactive, in-depth classes that focus on animal care, conservation biology, and zoological research.

Wildlife Conservation

Do you want to learn more about what the Zoo is doing to help save wildlife? Meet experts in the field and discover all of the hard work they do. Plus, find out how you can practice wildlife conservation at home!

AGES 10-14
DATES November 10, 17, 24;
December 1, 8
TIME 10 a.m.-1 p.m.
FEES \$175



A Wild Nature Exploration for Children in Grades K-5.

Just because it's winter doesn't mean you need to hibernate — the National Zoo's animals are ready to romp, and we are ready for you! Snow Safari campers at the Smithsonian's National Zoo will explore the lives, habitats, and conservation of animals around the world. Each four-day session includes exciting hands-on activities, craft projects, and science experiments. Participants will also meet National Zoo experts, go on exclusive tours, and experience private animal encounters. (Please note: There is never direct contact with the animals.) Join us as we launch a new winter extravaganza!

AGES: Camp sessions are grouped into three grade levels: K-1, 2-3, and 4-5. Snow Safari is not offered at the pre-K level. Children may only be registered for their current grade level.

DATES/TIMES: Sessions are held Monday through Thursday, Dec. 28-31, from 9 a.m. to 3 p.m. Campers must be dropped off between 8:45 and 9 a.m. After-Camp Care is offered in the Visitor Center classrooms from 3 to 6 p.m.

WHERE: All classes are held in the Visitor Center classrooms. Please pick up campers in parking lot A. Campers in After-Camp care must be picked up in the Visitor Center classrooms.

Registration begins November 10 at 10 a.m. To register, go to www.fonz.org/camps.htm.

Space is limited!

All confirmation materials will be sent via email upon registration.

FEES: A current FONZ household membership or higher is required to participate. Join online at www.fonz.org.

CAMP SESSION: \$260
AFTER-CAMP CARE: After Care is held in the Visitor Center classroom from 3 to 6 p.m. An additional fee will be charged after 6 p.m.
AFTER-CAMP CARE: \$95

CANCELLATION POLICY:

Cancellation requests received at least four weeks before the session will receive a 75 percent refund. Please email the FONZ Snow Safari Office at Fonz_programs@si.edu. No refunds or changes will be made for less than four weeks notice.

New Education Program for Children With Special Needs! Sensory Sensation

This winter, the National Zoo proudly presents a new program called Sensory Sensation. This class is designed to stimulate interactive learning for children with special needs. Engaging and entertaining, this program will awaken all five senses to the curious sights, sounds, smells, tastes, and feels of the nation's most hands-on outdoor classroom. Your child will learn about animals and have fun in a positive and nurturing environment.

AGES Elementary-school-age children (K-6)
(Chaperones are welcome.)
DATES: December 5
TIME: 1-3 p.m.
FEES: \$28



Flamingos

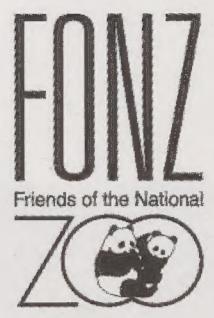
"These flamingos [*Phoenicopterus ruber*] caught my eye in the early morning light," said Caroline Treadway, a Smithsonian Zoogoer intern and photojournalism major. "The repeating circles of their pink necks against the green background drew me in."

"When I photograph animals at the Zoo, my curiosity runs wild." So why do flamingos sleep on one leg? According to the National Zoo's Associate Director of Animal Care Don Moore, it's more restful. Just as humans often shift their weight from one leg to another, so do flamingos!



Good day.

Great day.



Friends of the National Zoo, PO Box 37012, MRC 5516, NW, Washington, DC 20013-7012, www.fonz.org



Smithsonian
National Zoological Park

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Don't miss Conservation Stamp Day at the Zoo! November 14; 10am to 1pm.

Join the celebration! The first 300 kids that visit animals featured on Zoo customized postage stamps will get FREE Zoo giveaways. And everyone can enjoy special animal keeper talks. Plus, stamps will be available for purchase and if you spend \$50 at National Zoo Stores, you'll get a free sheet of 20 stamps! Find out more at www.fonz.org/stamps.htm.

